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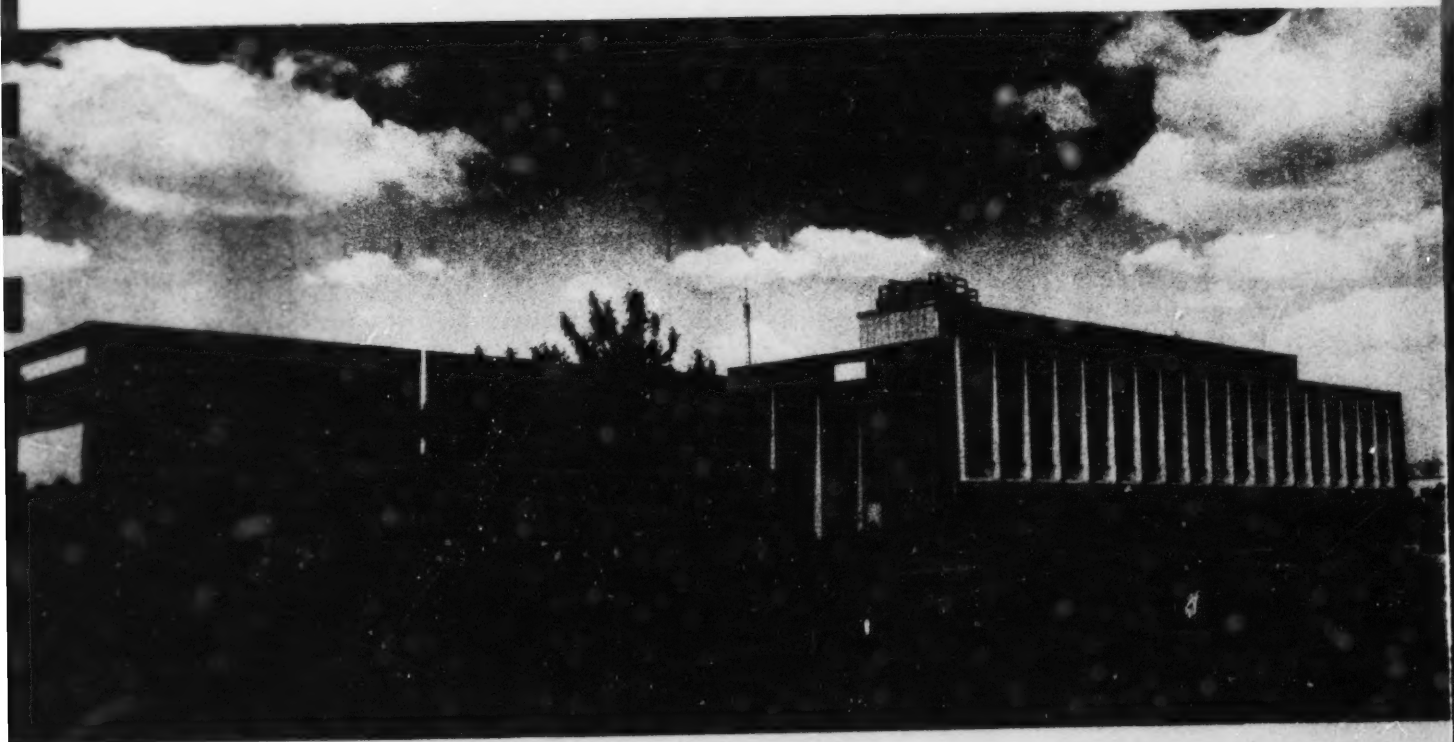

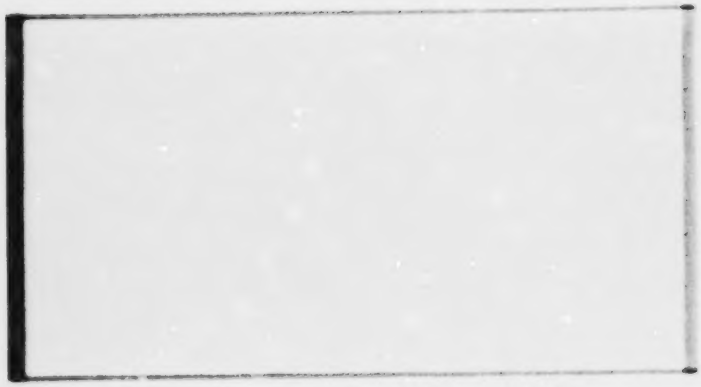

Named in honour of Dr. W.P. Dobson, the Research Division's director from 1914 to 1953, the building shown on the front cover was first occupied in 1961. Along with the adjacent pump testing complex and the high-voltage, high-current and radioactive materials laboratories, it accommodates much of the research, development and testing work performed in support of the diverse technical needs of Ontario Hydro.

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SOLAR WATER HEATERS - FIVE RESIDENTIAL INSTALLATIONS PART II - PERFORMANCE AND RELIABILITY

Report No 83-352-K

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ABSTRACT

Five solar water heaters installed in private residences proved to be reliable over two years of continuous operation and monitoring. Observations revealed that retrofit installations were not difficult. Summer daily efficiencies as high as 90% were recorded while on the average, the year-round solar contribution was about 34%. No major problems occurred after commissioning. Typical performance and hot water draw profiles are presented, and specific aspects of the operation, performance and system reliability are analyzed.

job	title	date	report no.
740612-108-113	814.333	October 7, 1983	83-352-K

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To Mr. G.E. Patterson
Director
Energy Conservation and
Utilization Division

SOLAR WATER HEATERS - FIVE RESIDENTIAL INSTALLATIONS PART II - PERFORMANCE AND RELIABILITY

INTRODUCTION

This report is an extension of Ontario Hydro Research Division Report No 81-167-K, "Solar Water Heaters - Five Residential Installations, Part I - Installation and Commissioning"/1/. It covers the operating and performance data for a two year monitoring period of the five solar domestic water heaters installed in private residences in Toronto during the 1980/81 winter season.

The primary objectives of the field installation program were to identify the retrofit installation problems in residences, examine the performance and reliability of solar systems in actual use, and determine the energy saving and cost-benefit ratio.

It was expected that the results of the field installation experiment would be of great assistance in:

- developing solar energy system performance standards and criteria as a guide for the acceptance and installation of such systems, and
- operating an information system for collecting, storing, reporting and disseminating the experimental data and the gained experience.

MAJOR SITE AND SYSTEM CHARACTERISTICS

The five sites were selected from seventy-seven applications. There was preference placed on homes in close proximity to the Research laboratory. The rooftop condition, inclination and orientation relative to south as well as the anticipated ease of installation were all considerations in the selection. Four of the homes were single storey (system #1, 2, 3, 5) and the other (system #4) was of double-storied construction. Also of

consequence was the family size. Households having at least three or more occupants were sought. It was reasoned that it would take this number of people to most effectively make use of the additional 310 L water storage tank capacity. The major site characteristics of the five selected houses are given in Table 1.

Table 1

SELECTED HOUSES CHARACTERISTICS/1/

System Number		1	2	3	4	5
Number of Occupants		6	6	3	4	4
Electric Water Heater* Capacity	L/Gal	180/40	270/60	180/40	180/40	180/40
Deviation from Due South Orientation	Deg	18E	40E	23E	13E	11E
Roof Slope	Deg	23	45	34	25	24
Shadow on "South Facing" Roof	%	0	-5	0	0	0
Available "South Facing" Roof Area	m^2	>9				

* Cascade EWH

A commercial "two-tank, closed loop system" which was approved during laboratory testing in 1979/1980 was installed in each house. All five systems were basically the same consisting of four roof-mounted solar collectors, a water preheater storage tank, an existing electric water heater, a heat exchanger and a pump-driven glycol circulation loop. The heat exchanger of wrap-around type was integral with the preheat storage tank. Characteristics of the major system components are listed in Table 2.

Table 2

MAJOR SYSTEM COMPONENTS CHARACTERISTICS/1/

Net collector area (m^2)	6.44	Solar Tank Capacity (L)	310
$F_R(\tau\alpha)_e$	0.75	Total Storage Capacity (L)	490*/580**
$F_R U_L$	6.35	Heat Exchanger Type	Wrap Around
Heat Transfer Fluid	Propylene-glycol	Control Type	Proportional
Collector Tilt/ Azimuth	Table 1 (roof slope)	Thermal Insulation Outside Inside	urethane (25 mm) fiberglass (25 mm)

* Systems 1, 3, 4, 5 (310 + 180)
** System 2 (310 + 270)

SYSTEM MONITORING AND DATA PROCESSING

All five systems were fully monitored using a "solar water heater monitor" package/1/. Two kWh meters were installed, one to measure the electric backup energy to the standard electric water heater and the other to indicate the energy consumed by the glycol circulator pump and its controls. The backup energy meter was equipped with a pulsing head and fed one channel of a three-channel digital demand recorder (DDR). The second channel of the recorder was fed by a heat flow integrator which measured the solar energy contributed to the water heating load. The third and final channel received its signal from a pulsing head equipped water flow meter installed in the domestic water supply line to the storage tank and recorded the house hot water demand. Thermometers were placed at pertinent temperature points around the system.

Integrated fifteen minute data of the system electrical demand (electrical back-up), solar preheat energy and hot water usage of the house were obtained by processing the information

recorded as a series of pulses on the DDR. The data from the DDR tape was audit checked to ensure that the difference pulse meter readings and the total tape pulse data correlate. Once the data was validated as accurate it was transferred to a computer compatible tape and assigned to a Standard Time Series (STS) file. Several quantities that were read manually have been recorded also. Homeowners were asked to submit weekly readings and trouble reports on suitable recording sheets. Additional readings were taken once a month by a technician when the DDR tape was changed and more often during the start-up of the system. This information was further processed and analyzed in order to evaluate the daily, weekly, monthly and annual system performance.

FIELD TRIAL RESULTS

Performance

Table 3 illustrates a sample of a computer generated daily performance print-out of one of the systems tested.

Table 3

SYSTEM #3 - STS PRINT-OUT
(Sample of Daily Performance Results)

	ELECT BACKUP KWH		SOLAR PREHEAT KWH		HOT WATER USAGE LITRES		% SOLAR CNTR	
	169222241		169222242		169111143		169555542	
DATE + TIME	VALUE	QUAL*	VALUE	QUAL*	VALUE	QUAL*	VALUE	QUAL*
1981 2 1 24 0	21.4	40	6.6	40	405.0	40	23.6	40
1981 2 2 24 0	9.6	40	.7	40	110.5	40	7.0	40
1981 2 3 24 0	6.4	40	1.5	40	63.5	40	19.5	40
1981 2 4 24 0	12.2	40	6.2	40	212.0	40	33.8	40
1981 2 5 24 0	8.5	40	1.4	40	95.0	40	14.6	40
1981 2 6 24 0	9.6	40	1.0	40	53.5	40	15.0	40
1981 2 7 24 0	10.3	40	2.3	40	153.5	40	18.6	40
1981 2 8 24 0	18.0	40	5.6	40	276.5	40	23.8	40

*QUAL 40 indicates 100% validated data.

An example of a computer print-out plot is given in Figure 1. The daily totals of the hot water consumption (L), solar preheat energy (kWh), electrical back-up energy (kWh), as well as the solar contribution to water heating (%) are presented. Typical monthly performance profiles are given in Figure 2.

A more complete record of the performance of each of the five systems is given in Appendices C and D. Typical summer and winter results are presented for the purpose of comparison.

An overview of the performance of the five systems over the two year test period (1981/82) and the average data for the two years is shown in Table 4.

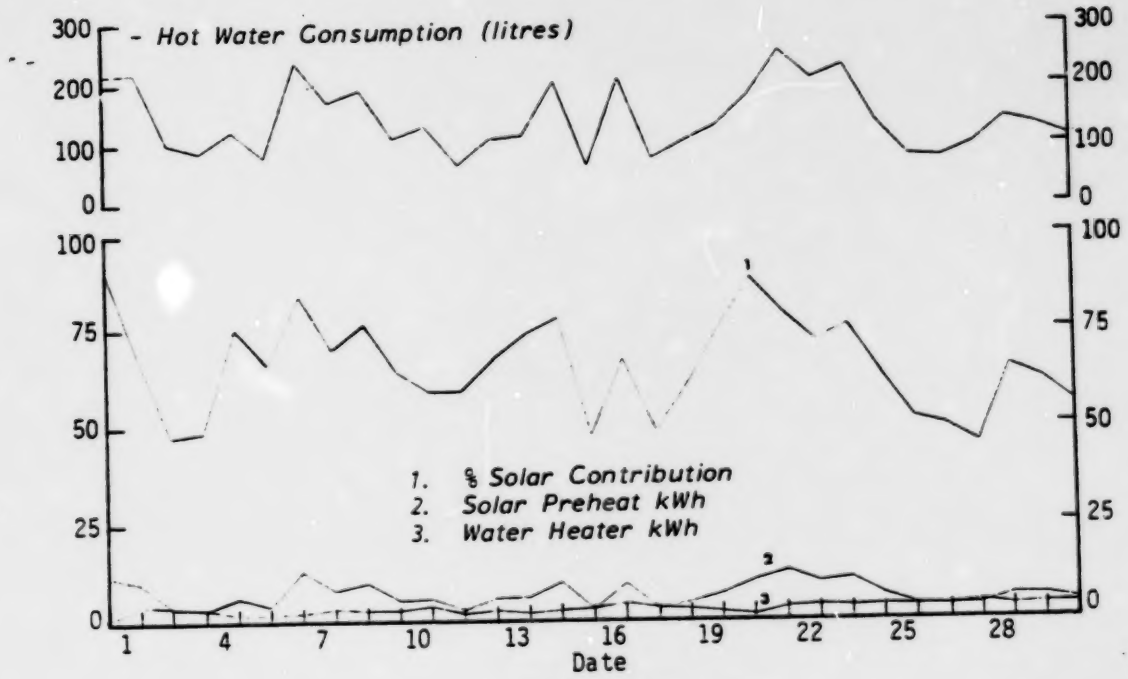

FIGURE 1

SYSTEM NO. 1 - DAILY PERFORMANCE PROFILES FOR JULY, 1982

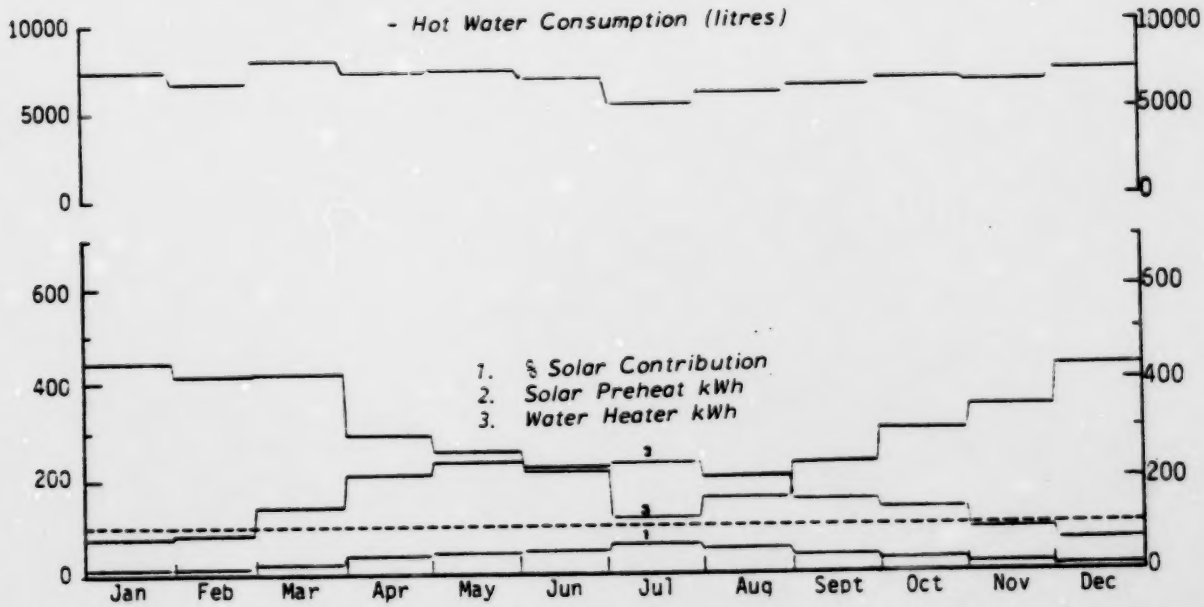

FIGURE 2

MONTHLY PERFORMANCE PROFILES, 1982 - (Average of Five Installations)

83-352
162459 RD

TABLE 4

ANNUAL SYSTEM PERFORMANCE

QUANTITY		SYSTEM 1			SYSTEM 2			SYSTEM 3			SYSTEM 4			SYSTEM 5		
		1981	1982	AVG	1981	1982	AVG	1981	1982	AVG	1981	1982	AVG	1981	1982	AVG
WATER CONSUMPTION																
Total Cold Water Usage	litres	373630	331443	352537	432310	445587	438949	236110	238238	237174	357400	330525	343963	339200	314655	326928
Hot Water Usage	litres	69350	62809	66080	77270	91705	84488	55430	63045	59238	111640	119438	115539	88390	83040	85715
Hot/Cold Water Usage ratio	percent	19	19	19	18	21	20	23	26	25	31	36	34	26	26	26
THERMAL ENERGY																
Solar Preheat Energy	kWh	1656	1556	1606	1637	1996	1817	1745	2052	1899	1992	2468	2230	1924	1997	1961
ELECTRICAL ENERGY																
Auxiliary Heating Elements	kWh	3089	3054	3072	3664	3598	3631	3087	3304	3196	4775	4519	4647	4298	3887	4093
Pump and Controls	kWh	44	50	47	73	79	76	65	101	83	52	62	57	79	103	91
PERFORMANCE INDICATORS																
Hot Water Usage Daily Average	litres/day	190	172	181	212	251	232	152	173	163	306	327	317	242	228	235
Solar Contribution to Water Heating	percent	35	33	34	31	34	33	36	36	36	30	34	32	31	32	32
Collected Solar Energy Daily Average	kWh/day	4.54	4.26	4.40	4.48	5.47	4.98	4.78	5.62	5.20	5.46	6.76	6.11	5.27	5.47	5.37
Collected Solar Energy Daily Average per Unit Area of Solar Collector	kWh/m² day	0.70	0.66	0.68	0.70	0.85	0.78	0.74	0.87	0.81	0.85	1.05	0.95	0.82	0.85	0.84
SPECIFIC ENERGY CONSUMPTION																
Solar Preheat	kWh/L	0.024	0.025	0.024	0.021	0.022	0.022	0.031	0.033	0.032	0.018	0.021	0.019	0.022	0.024	0.023
Electrical Back-up	kWh/L	0.045	0.049	0.046	0.047	0.039	0.043	0.056	0.052	0.054	0.043	0.038	0.040	0.049	0.047	0.048
TOTAL	kWh/L	0.069	0.074	0.070	0.068	0.061	0.065	0.087	0.085	0.086	0.061	0.059	0.059	0.071	0.071	0.071

A statistical analysis was done on the hot water draw schedule. Hourly hot water consumption data were averaged for all systems by the day of the week. A typical daily demand profile was then plotted. Figure 3 illustrates a "typical Thursday" and "Sunday" respectively. Complete graphical representations including a "typical week" hot water draw profile are given in Appendix A.

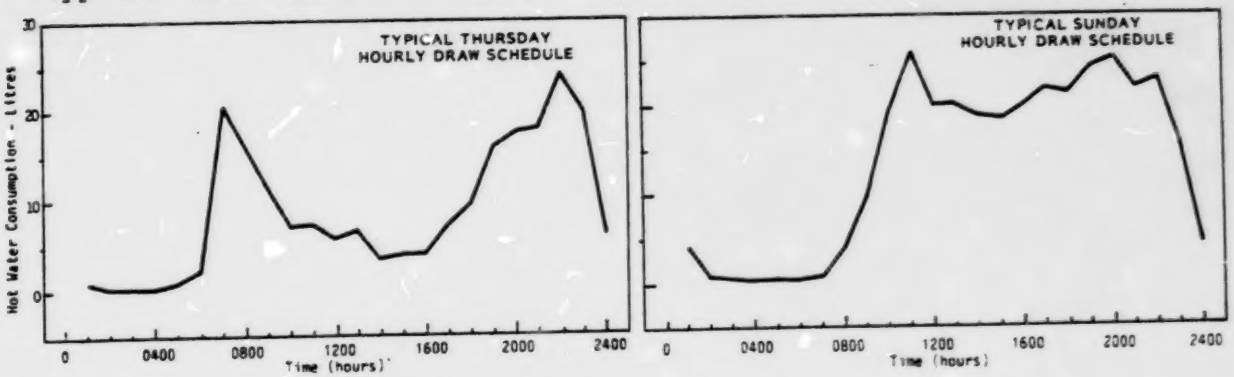

FIGURE 3

TYPICAL HOT WATER CONSUMPTION PROFILES

OPERATION

No major operational problems were recorded during the two year test period. However, some of the troubles encountered are presented in Table 5. A detailed trouble analysis is presented in Appendix B.

Table 5

TROUBLE ANALYSIS

Type of Trouble	System and Counts of Troubles				
	1	2	3	4	5
Glazing shattered		1	1	1	1
Leak at joint	1				
Fault in check valve	1	1	1	1	1
Fault in tempering valve		1		1	1
Fault in T/P valve		1	1		1
Fault in sensor					1
Fault in wiring				1	1
Instrumentation		1			1
TOTAL	2	5	3	4	7

The operational time of each system is given in Table 6. This indicator has been considered as a measure of the system reliability during the analyzed period.

Table 6

SYSTEM RELIABILITY

Test Time	System				
	1	2	3	4	5
Number of days in test period	730	730	730	730	730
Number of days system operational	729	730	730	710	725
Operation Time Ratio (%)	99.9	100	100	97.3	99.3

NOTE: The operational time takes into account the number of days when the system was not in operation because of mechanical and/or electrical troubles only. It does not count the number of days when the system was not in operation because of bad weather, snow or ice build up on the collector array or when the glazing was shattered and the system continued to operate but less efficiently.

DISCUSSION

The overall performance of the five systems in the field trial was found to be satisfactory. The solar energy supplied to the electric storage tanks was between 1600 to 2200 kWh/a with a solar contribution of about 34% on the average. Summer peaks over 90% were also recorded. Interestingly, despite considerable differences in climatological conditions between the two years, the solar contribution to water heating was about the same (Table 4). The analysis of the results revealed that the amount of solar energy supplied to the house load is strongly influenced by the hot water load. Calculation showed that on the average, the system provided about 4.4 to 6.1 kWh/day throughout the test period. The differences from house-to-house can be explained by different tilts and orientations of the solar collectors, variations in daily hot water usage and pattern as well as by periods of partial operation due to mechanical or electrical troubles, bad weather or ice and snow build-up on the collector array.

One of the results of the experiment was the measurement and the recording, on a 15 minute basis, of the actual hot water consumption of the residences over two years. The total cold water consumption was recorded weekly. This unique data allowed the development of "typical" residential hot water consumption patterns. These patterns have wide application not only in solar energy systems but also in the design testing and development of other types of water heaters. These types could include electric, gas and oil water heaters, heat pump water heaters, ventilation heat recovery devices and waste water heat recovery systems.

The mechanical reliability of the five systems was found to be very good with the exception that the collector glazing shattered on four of the five systems shortly after commissioning. This was probably because of defective assembling. No other major troubles were recorded. Thus, the systems including the heat transfer fluid (propylene glycol) proved to be reliable.

CONCLUSIONS

The field trial results analysis indicated that:

1. Reliable indirect systems are available, offering annual solar contributions of up to 2200 kWh/a (~34% of the residential hot water load).

2. Summer peaks of up to 18 kWh/day (over 90% of the energy required for domestic water heating) were recorded.

3. Retrofit installations were not difficult and proved to be reliable over two years of continuous operation and monitoring.

4. The development of "typical" residential hot water consumption patterns is unique and has wide application not only in solar energy systems but also in the design, testing and development of other types of water heaters.

ACKNOWLEDGEMENTS

The authors wish to express their gratitude to the homeowners for their contribution and assistance to the successful completion of this project.

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3. Perlman, M., "On the Performance and Reliability of Residential Solar Water Heaters", Proceedings of the Solar Hot Water Field Test Technical Review Meeting, Atlanta, Ga, 1982, pp 35-49.

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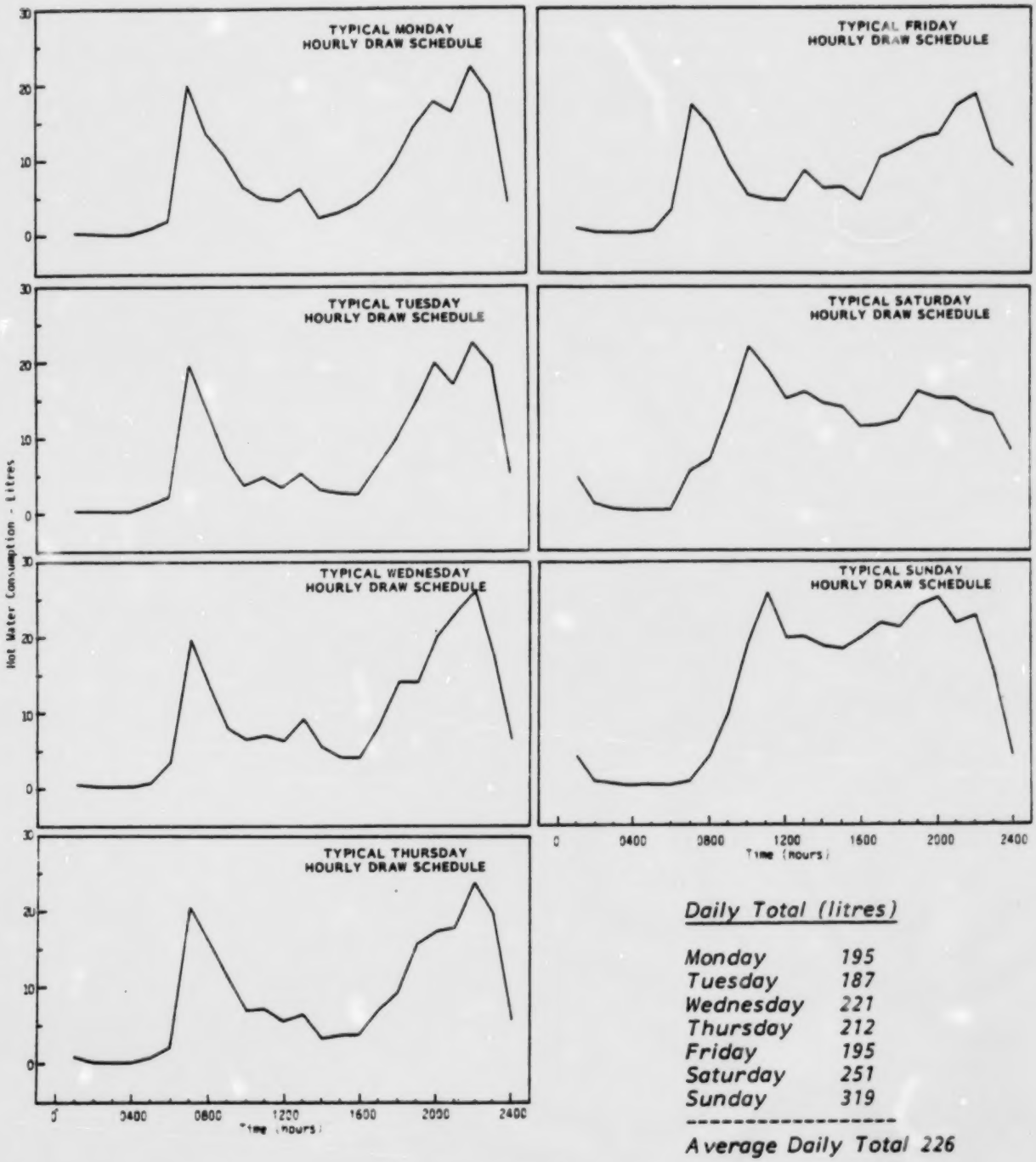
3. Perlman, M., "On the Performance and Reliability of Residential Solar Water Heaters", Proceedings of the Solar Hot Water Field Test Technical Review Meeting, Atlanta, Ga, 1982, pp 35-49.

APPENDIX A

HOURLY AND DAILY TYPICAL HOT WATER CONSUMPTION PROFILES (AVERAGE OF FIVE RESIDENCES)

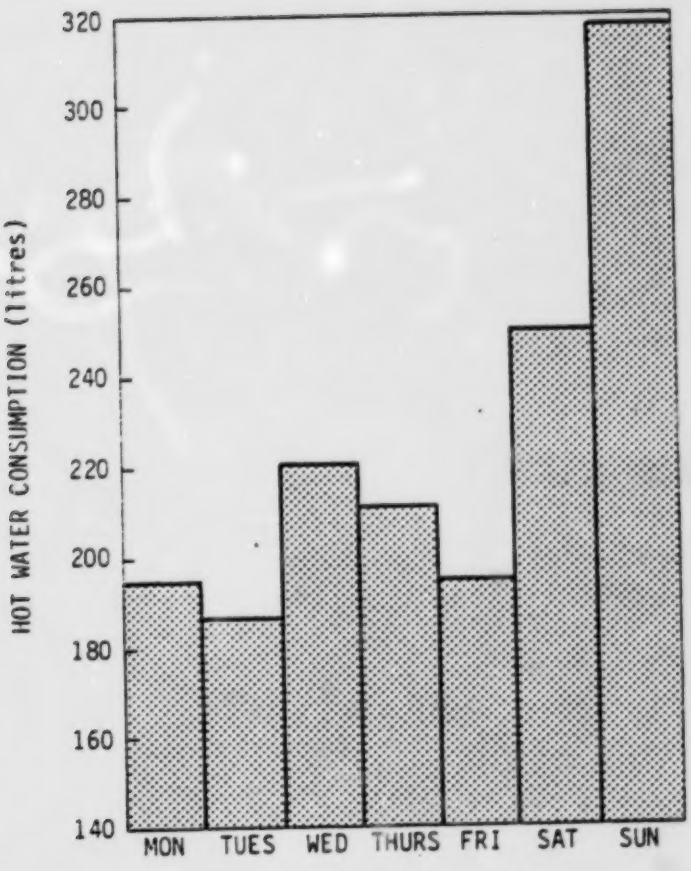


Daily Total (litres)

Monday	*195*
Tuesday	*187*
Wednesday	*221*
Thursday	*212*
Friday	*195*
Saturday	*251*
Sunday	*319*

Average Daily Total 226

TYPICAL DAYS - HOURLY HOT WATER CONSUMPTION PROFILES



TYPICAL WEEK - DAILY HOT WATER CONSUMPTION PROFILE

APPENDIX B

SYSTEM INSTALLATION AND OPERATION DISCUSSION

PLUMBING

Difficulties arose in trying to obtain plumbing approval from the municipal plumbing inspection office. The query regarded the use of propylene glycol as heat transfer fluid in close proximity to the potable water in the system. The propylene glycol used in the five installations was considered practically non-toxic, even in quantity/2,3/, but the plumbing inspector was still concerned. Approval was eventually granted after demonstrating that the heat-transfer fluid is circulated in a double-walled wrap-around heat exchanger surrounding the storage tank. The use of propylene glycol, together with a double wall heat exchanger, was considered to provide double protection for the potable water.

BACKFLOW PREVENTER

Although the heat transfer fluid (propylene glycol) was considered practically non-toxic, a back-flow prevention valve was requested as an additional safety precaution. This valve was installed ahead of the solar storage tank on the city water feed line. It was assumed that the installation of a backflow preventer will avoid any possibility of a defective heat exchanger mixing heat transfer fluid with the city water supply.

Because of the backflow preventer, an expansion tank was required to allow for expansion of the cold water when heated in the system. The volume of the expansion tank was initially undersized and this caused the pressure relief valves to vent periodically. The size of this tank was revised and the units replaced in all five installations.

COLLECTOR GLAZING

Shortly after commissioning, the collector glazing shattered on one panel at each of four homes. A close examination done on the sites showed that the breakage was not the result of external causes and that it must have occurred due to stresses set up on the glass during manufacture. The replacement of the collector glazing involved a careful removal of the shattered glass, removal replacement of the rain wetted insulation beneath the absorber plate, installation of a new piece of glass and weather stripping. There were usually several days before a service person arrived on the site to repair the glazing. The systems did remain in operation during this period but at a lower efficiency.

CHECK VALVES

Each system was equipped with a check valve installed in the glycol circulation loop downstream of the circulator pump. This valve prevented thermal siphoning of the glycol when the

circulator was not in operation, such as at night or during periods of very low solar radiation. All five systems developed a minor leak at the pivot screw on these valves and it became necessary to refill the glycol loops. The pivot screws were sealed with a thread sealant compound and the leaking ceased.

TEMPERING VALVES

Tempering valves were installed on the domestic hot water discharge from the electric tank. These valves had a cold water line inlet as well. The function of the tempering valves was to mix in cold water with the hot water from the tank if scalding temperatures (60°C and higher) were present. The concern was that in the summer time the storage tank temperature could be much higher than an acceptable delivery temperature of 60°C. During the experiment it was found that the quality of these valves was not as good as expected. Several of these valves were mixing cold with hot water all the time even though the tempering temperature (60°C) was not reached. This constant mixing condition counted in many cases for cooler than desired hot water delivery temperatures. Due to the fact that even during mid-summer the solar storage tank temperature never reached values such as to require the tempering valves to operate, it was decided to remove them from the systems altogether.

TEMPERATURE/PRESSURE RELIEF VALVE

In the spring of 1982 several of the T/P relief valves on the solar storage tanks became defective. Homeowners reported substantial amounts of solar heated water venting down the drain while the sun was shining. It was discovered that the temperature relief point had shifted from its calibrated 99°C to about 30°C. Since this happened at more than one installation it was believed that the valves were all from a defective production run. The valves were replaced at all five locations and since then have performed well.

SENSORS AND WIRING

After commissioning in two of the five installations, solar contributions well below 10% were recorded. An equipment malfunction was evident. Measurements showed that the wiring of the collector temperature sensor was open circuited at both homes. The trouble was traced to poor workmanship at the connection of the sensor to its wiring.

COLLECTOR SPACING

A standoff frame of about 10 cm was used to support the collectors off of the roof to allow drainage. One homeowner reported persistent nesting of squirrels in this convenient space. The squirrels were chewing pieces off of the roof shingles. After a

close examination on the site it was suggested that future installations have the access to this space sealed off with wire mesh.

HEAT TRANSFER FLUID

Fresh propylene-glycol was put into the system about one year after commissioning at the same time as the check valve repair. A strainer-filter installed in the glycol circulation loop was cleaned and inspected at this time. A pasty beige sludge was found in the filter apparently deposited from the glycol. A close examination showed that the sludge was the excess soldering flux remaining in the glycol loop from the plumbing connections. The pH and specific gravity of the glycol were checked every six months and the results recorded. Recommendations were made to the homeowners regarding periodic testing and preventive maintenance.

There was an apparent undersizing of the expansion tanks on the glycol loops. The solar intensity of the summer season and the resulting heat buildup caused the glycol to expand to its maximum. The expansion tank seemed undersized as the pressure relief valve vented small amounts of glycol from time to time. The systems were recharged in the winter months due to the decreased outdoor temperature and therefore low pressure.

APPENDIX C

SAMPLES OF DAILY PERFORMANCE RESULTS
(STS - COMPUTER PRINTOUTS)
(WINTER & SUMMER 1981 AND 1982
FOR EACH OF FIVE SYSTEMS)

System 71

DATE 830425

DATE + TIME	ELECT. BACKUP KWH 169222271		SOLAR PREHEAT KWH 169222272		HOT WATER USAGE LITRES X 169111173		SOLAR CNTR 169555572	
	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL
1981 2 1 24 0	4.8	33	1.0	33	56.5	33	17.0	33
1981 2 2 24 0	10.9	40	1.3	40	148.0	40	10.9	40
1981 2 3 24 0	9.7	40	1.0	40	114.0	40	9.7	40
1981 2 4 24 0	7.4	40	1.6	40	116.0	40	17.8	40
1981 2 5 24 0	12.4	40	5.0	40	310.5	40	28.6	40
1981 2 6 24 0	13.2	40	1.0	40	162.5	40	7.0	40
1981 2 7 24 0	13.7	40	1.4	40	209.0	40	9.1	40
1981 2 8 24 0	8.9	40	.7	40	121.5	40	7.0	40
1981 2 9 24 0	17.0	40	2.8	40	347.5	40	14.4	40
1981 2 10 24 0	16.2	40	.8	40	226.0	40	5.0	40
1981 2 11 24 0	14.0	40	.5	40	172.5	40	3.8	40
1981 2 12 24 0	10.7	40	2.2	40	160.5	40	16.9	40
1981 2 13 24 0	9.8	40	4.9	40	192.5	40	33.2	40
1981 2 14 24 0	12.1	40	6.8	40	269.0	40	36.1	40
1981 2 15 24 0	10.3	40	3.6	40	182.0	40	25.9	40
1981 2 16 24 0	10.9	40	2.0	40	174.0	40	15.6	40
1981 2 17 24 0	9.1	40	.7	40	116.5	40	7.4	40
1981 2 18 24 0	10.9	40	2.5	40	193.5	40	18.5	40
1981 2 19 24 0	17.2	40	2.6	40	293.0	40	13.1	40
1981 2 20 24 0	14.1	40	.9	40	170.0	40	5.8	40
1981 2 21 24 0	14.6	40	1.7	40	224.5	40	10.6	40
1981 2 22 24 0	13.9	40	2.1	40	226.0	40	13.4	40
1981 2 23 24 0	8.4	40	.6	40	103.0	40	6.4	40
1981 2 24 24 0	7.6	40	.8	40	109.0	40	9.2	40
1981 2 25 24 0	8.3	40	.8	40	91.0	40	8.6	40
1981 2 26 24 0	8.6	40	2.9	40	141.5	40	25.6	40
1981 2 27 24 0	10.1	40	9.5	40	268.5	40	48.5	40
1981 2 28 24 0	15.8	40	4.7	40	295.0	40	23.2	40

System 1

DATE 830425

DATE + TIME	ELECT. BACKUP KWH 169222271		SOLAR PREHEAT KWH 169222272		HOT WATER USAGE LITRES 169111173		X SOLAR CNTR 169555572	
	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL
1981 7 1 24 0	6.8	40	9.3	40	257.0	40	57.8	40
1981 7 2 24 0	5.0	40	5.5	40	157.0	40	52.2	40
1981 7 3 24 0	2.3	40	9.1	40	168.5	40	79.5	40
1981 7 4 24 0	3.7	40	6.8	40	152.0	40	65.0	40
1981 7 5 24 0	2.8	40	1.7	40	49.0	40	39.3	40
1981 7 6 24 0	2.7	40	14.7	40	293.0	40	84.4	40
1981 7 7 24 0	4.8	40	17.2	40	366.5	40	78.3	40
1981 7 8 24 0	3.9	40	10.1	40	226.0	40	72.1	40
1981 7 9 24 0	3.7	40	7.1	40	168.5	40	65.5	40
1981 7 10 24 0	2.5	40	9.3	40	177.5	40	79.0	40
1981 7 11 24 0	1.4	40	13.6	40	260.0	40	90.7	40
1981 7 12 24 0	5.7	40	9.5	40	216.5	40	62.5	40
1981 7 13 24 0	4.4	40	5.9	40	144.5	40	57.2	40
1981 7 14 24 0	1.9	40	6.9	40	130.5	40	78.7	40
1981 7 15 24 0	1.3	40	15.1	40	251.0	40	92.1	40
1981 7 16 24 0	5.1	40	8.7	40	208.0	40	62.8	40
1981 7 17 24 0	4.6	40	7.7	40	183.5	40	62.4	40
1981 7 18 24 0	5.7	40	14.0	40	348.5	40	71.0	40
1981 7 19 24 0	4.7	40	8.6	40	218.5	40	64.7	40
1981 7 20 24 0	8.5	40	3.5	40	181.5	40	29.0	40
1981 7 21 24 0	6.0	40	2.1	40	112.0	40	26.2	40
1981 7 22 24 0	3.1	40	7.0	40	160.5	40	69.6	40
1981 7 23 24 0	2.6	40	10.3	40	203.5	40	79.3	40
1981 7 24 24 0	4.2	40	5.3	40	119.0	40	55.9	40
1981 7 25 24 0	1.9	40	5.1	40	106.0	40	72.7	40
1981 7 26 24 0	8.3	40	8.5	40	279.5	40	50.5	40
1981 7 27 24 0	7.4	40	5.9	40	218.5	40	44.5	40
1981 7 28 24 0	5.5	40	2.8	40	125.5	40	34.1	40
1981 7 29 24 0	5.4	40	4.5	40	160.5	40	45.5	40
1981 7 30 24 0	3.2	40	10.9	40	260.5	40	77.5	40
1981 7 31 24 0	4.0	40	9.3	40	209.0	40	69.8	40

System #1

DATE 830425

DATE + TIME	ELECT. BACKUP KWH 169222271		SOLAR PREHEAT KWH 169222272		HOT WATER USAGE LITRES 169111173		X SOLAR CNTR 169555572	
	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL
1982 2 1 24 0	10.7	40	.4	40	135.5	40	3.8	40
1982 2 2 24 0	9.9	40	.4	40	130.0	40	4.1	40
1982 2 3 24 0	17.7	40	1.7	40	345.5	40	9.0	40
1982 2 4 24 0	14.9	40	1.1	40	137.0	40	7.0	40
1982 2 5 24 0	9.0	40	2.0	40	135.0	40	18.4	40
1982 2 6 24 0	7.7	40	.6	40	96.0	40	7.8	40
1982 2 7 24 0	6.8	40	.4	40	73.5	40	5.2	40
1982 2 8 24 0	10.3	40	.8	40	162.5	40	7.4	40
1982 2 9 24 0	12.4	40	.6	40	154.5	40	4.6	40
1982 2 10 24 0	13.6	40	1.1	40	195.5	40	7.6	40
1982 2 11 24 0	13.3	40	1.2	40	213.5	40	8.1	40
1982 2 12 24 0	12.3	40	.5	40	139.0	40	3.9	40
1982 2 13 24 0	13.5	40	2.4	40	213.0	40	15.0	40
1982 2 14 24 0	14.1	40	4.5	40	287.0	40	24.1	40
1982 2 15 24 0	9.7	40	2.3	40	140.5	40	19.2	40
1982 2 16 24 0	7.6	40	3.5	40	159.0	40	31.7	40
1982 2 17 24 0	11.6	40	5.6	40	217.0	40	32.4	40
1982 2 18 24 0	10.1	40	2.4	40	155.5	40	19.5	40
1982 2 19 24 0	9.4	40	1.2	40	139.5	40	11.3	40
1982 2 20 24 0	14.1	40	1.7	40	254.0	40	10.9	40
1982 2 21 24 0	14.9	40	1.0	40	211.0	40	6.3	40
1982 2 22 24 0	15.1	40	1.0	40	202.5	40	6.3	40
1982 2 23 24 0	13.4	40	1.1	40	212.0	40	7.4	40
1982 2 24 24 0	21.6	40	1.9	40	369.5	40	8.0	40
1982 2 25 24 0	17.0	40	6.1	40	271.0	40	26.5	40
1982 2 26 24 0	11.2	40	3.3	40	160.5	40	22.7	40
1982 2 27 24 0	7.9	40	7.7	40	231.5	40	49.4	40
1982 2 28 24 0	9.5	40	3.7	40	136.5	40	28.3	40

System 21

DATE 830425

ELECT. BACKUP KWH SOLAR PREHEAT KWH HOT WATER USAGE LITRES % SOLAR CNTR

DATE + TIME	169222271		169222272		169111173		169555572	
	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL
1982 7 1 24 0	1.1	40	12.2	40	210.5	40	91.5	40
1982 7 2 24 0	4.6	40	10.2	40	213.0	40	68.8	40
1982 7 3 24 0	4.1	40	3.8	40	99.5	40	48.0	40
1982 7 4 24 0	3.6	40	3.4	40	85.5	40	49.1	40
1982 7 5 24 0	2.0	40	6.4	40	119.5	40	75.8	40
1982 7 6 24 0	2.2	40	4.2	40	78.0	40	66.3	40
1982 7 7 24 0	2.4	40	13.1	40	230.5	40	84.3	40
1982 7 8 24 0	3.4	40	8.1	40	166.5	40	70.5	40
1982 7 9 24 0	3.0	40	10.0	40	185.5	40	76.9	40
1982 7 10 24 0	3.1	40	5.6	40	108.0	40	64.7	40
1982 7 11 24 0	4.1	40	5.9	40	126.5	40	59.5	40
1982 7 12 24 0	2.1	40	3.1	40	64.5	40	59.5	40
1982 7 13 24 0	2.9	40	6.1	40	105.5	40	67.7	40
1982 7 14 24 0	2.2	40	6.2	40	110.5	40	74.2	40
1982 7 15 24 0	2.8	40	10.0	40	197.0	40	78.3	40
1982 7 16 24 0	3.2	40	3.0	40	62.0	40	48.0	40
1982 7 17 24 0	4.5	40	9.5	40	202.5	40	67.7	40
1982 7 18 24 0	3.4	40	3.2	40	73.5	40	48.8	40
1982 7 19 24 0	3.0	40	4.6	40	101.0	40	61.1	40
1982 7 20 24 0	2.2	40	6.9	40	125.5	40	76.2	40
1982 7 21 24 0	1.3	40	10.2	40	173.0	40	88.5	40
1982 7 22 24 0	3.3	40	12.6	40	245.5	40	79.4	40
1982 7 23 24 0	3.7	40	9.6	40	201.5	40	72.2	40
1982 7 24 24 0	3.3	40	10.6	40	222.5	40	76.1	40
1982 7 25 24 0	3.6	40	6.2	40	132.5	40	63.7	40
1982 7 26 24 0	3.3	40	3.6	40	78.0	40	52.1	40
1982 7 27 24 0	3.3	40	3.3	40	74.5	40	49.9	40
1982 7 28 24 0	4.3	40	3.5	40	95.5	40	45.3	40
1982 7 29 24 0	3.1	40	5.8	40	137.5	40	65.3	40
1982 7 30 24 0	3.5	40	5.7	40	125.5	40	61.8	40
1982 7 31 24 0	3.5	40	4.3	40	106.5	40	55.4	40

System E:

DATE 830425

DATE + TIME	ELECT. BACKUP KWH 169222131		SOLAR PREHEAT KWH 169222132		HOT WATER USAGE LITRES 169111133		% SOLAR CNTR 169555132	
	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL
1981 2 9 24 0	4.8	40	.0	40	7.5	40	.0	40
1981 2 10 24 0	18.8	40	.3	40	85.5	40	1.8	40
1981 2 11 24 0	12.5	40	.4	40	38.0	40	3.5	40
1981 2 12 24 0	10.5	40	1.3	40	48.5	40	10.8	40
1981 2 13 24 0	7.1	40	.5	40	18.5	40	6.6	40
1981 2 14 24 0	12.0	40	3.0	40	86.0	40	20.1	40
1981 2 15 24 0	33.9	40	3.3	40	211.0	40	8.9	40
1981 2 16 24 0	24.7	40	.5	40	111.5	40	2.1	40
1981 2 17 24 0	14.7	40	.2	40	39.5	40	1.3	40
1981 2 18 24 0	7.6	40	.1	40	17.0	40	1.6	40
1981 2 19 24 0	12.4	40	.7	40	57.0	40	5.3	40
1981 2 20 24 0	9.8	40	.3	40	39.5	40	3.0	40
1981 2 21 24 0	18.5	40	1.0	40	91.5	40	5.0	40
1981 2 22 24 0	34.3	40	1.3	40	191.5	40	3.7	40
1981 2 23 24 0	23.9	40	.4	40	109.0	40	1.5	40
1981 2 24 24 0	13.2	40	.6	40	61.0	40	4.5	40
1981 2 25 24 0	7.9	40	.3	40	25.0	40	3.4	40
1981 2 26 24 0	14.7	40	3.4	40	105.5	40	18.8	40
1981 2 27 24 0	6.4	40	.7	40	26.0	40	10.4	40
1981 2 28 24 0	8.0	40	1.3	40	44.0	40	13.9	40

Note: Monitoring Equipment not Operational February 1 - 8.

System #:

DATE 830425

DATE + TIME	ELECT. BACKUP KWH 169222131		SOLAR PREHEAT KWH 169222132		HOT WATER USAGE LITRES X SOLAR CNTR 169111133		169555132	
	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL
1981 7 1 24 0	5.4	40	1.9	40	70.0	40	26.1	40
1981 7 2 24 0	4.9	40	4.7	40	132.0	40	49.0	40
1981 7 3 24 0	1.8	40	3.1	40	58.5	40	63.1	40
1981 7 4 24 0	1.6	40	6.7	40	126.5	40	80.8	40
1981 7 5 24 0	7.4	40	9.6	40	273.0	40	56.3	40
1981 7 6 24 0	3.9	38	1.7	38	60.5	38	30.7	38
1981 7 7 24 0	2.4	40	3.5	40	72.5	40	60.0	40
1981 7 8 24 0	2.2	40	1.2	40	21.5	40	36.0	40
1981 7 9 24 0	1.9	40	.6	40	11.5	40	25.3	40
1981 7 10 24 0	1.2	40	10.7	40	153.0	40	89.9	40
1981 7 11 24 0	.9	40	1.4	40	25.5	40	61.9	40
1981 7 12 24 0	2.0	40	4.0	40	70.5	40	66.3	40
1981 7 13 24 0	2.3	40	1.9	40	39.5	40	45.6	40
1981 7 14 24 0	1.7	40	5.1	40	78.5	40	75.3	40
1981 7 15 24 0	.8	40	20.5	40	355.0	20	96.4	40
1981 7 16 24 0	2.4	40	1.1	40	24.0	20	32.1	40
1981 7 17 24 0	2.5	40	2.6	40	53.0	20	51.6	40
1981 7 18 24 0	2.7	40	1.3	40	26.0	20	33.0	40
1981 7 19 24 0	1.4	40	7.4	40	135.0	20	84.3	40
1981 7 20 24 0	5.1	40	8.7	40	226.5	20	63.2	40
1981 7 21 24 0	7.7	40	3.2	40	180.0	20	29.4	40
1981 7 22 24 0	2.9	40	3.9	40	104.5	20	57.2	40
1981 7 23 24 0	1.5	40	13.1	40	232.0	20	90.0	40
1981 7 24 24 0	2.7	40	7.5	40	165.5	20	73.6	40
1981 7 25 24 0	4.8	40	4.4	40	126.5	20	48.0	40
1981 7 26 24 0	2.3	40	.4	40	16.0	20	15.8	40
1981 7 27 24 0	6.5	40	5.3	40	201.5	20	44.9	40
1981 7 28 24 0	5.3	40	7.4	40	224.5	20	58.5	40
1981 7 29 24 0	3.8	40	.7	40	35.0	20	15.1	40
1981 7 30 24 0	2.7	40	.7	40	19.0	20	21.4	40
1981 7 31 24 0	2.3	40	2.2	40	46.0	20	49.0	40

System #2

DATE 830425

DATE + TIME	ELECT. BACKUP KWH 169222131		SOLAR PREHEAT KWH 169222132		HOT WATER USAGE LITRES X 169111133		SOLAR CNTR 169555132	
	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL
1982 2 1 24 0	17.7	40	2.2	40	157.5	40	10.9	40
1982 2 2 24 0	10.3	40	4.3	40	216.5	40	29.7	40
1982 2 3 24 0	10.8	40	1.6	40	166.5	40	12.7	40
1982 2 4 24 0	9.3	40	3.7	40	182.0	40	28.5	40
1982 2 5 24 0	5.4	40	1.1	40	58.0	40	17.0	40
1982 2 6 24 0	9.2	40	3.2	40	173.0	40	25.6	40
1982 2 7 24 0	18.6	40	10.5	40	463.5	40	36.1	40
1982 2 8 24 0	15.0	40	3.6	40	280.5	40	19.3	40
1982 2 9 24 0	7.7	40	4.2	40	158.0	40	35.1	40
1982 2 10 24 0	8.0	40	7.6	40	223.0	40	48.7	40
1982 2 11 24 0	7.2	40	2.0	40	98.0	40	21.7	40
1982 2 12 24 0	5.9	40	1.0	40	66.0	40	14.4	40
1982 2 13 24 0	8.4	40	7.3	40	218.0	40	46.6	40
1982 2 14 24 0	16.7	40	6.6	40	365.0	40	28.3	40
1982 2 15 24 0	17.3	40	9.7	40	439.0	40	35.8	40
1982 2 16 24 0	6.1	40	1.8	40	89.0	40	22.5	40
1982 2 17 24 0	9.2	40	8.1	40	302.0	40	46.7	40
1982 2 18 24 0	18.0	40	5.7	40	382.0	40	24.2	40
1982 2 19 24 0	7.2	40	.3	40	81.0	40	4.6	40
1982 2 20 24 0	13.3	40	1.5	40	220.5	40	10.3	40
1982 2 21 24 0	27.8	40	2.4	40	500.5	40	7.9	40
1982 2 22 24 0	13.8	40	.8	40	214.5	40	5.3	40
1982 2 23 24 0	6.9	40	.3	40	78.0	40	4.2	40
1982 2 24 24 0	9.1	40	1.1	40	139.5	40	11.2	40
1982 2 25 24 0	4.8	40	9.3	40	321.0	40	65.9	40
1982 2 26 24 0	4.8	40	10.5	40	325.0	40	68.6	40
1982 2 27 24 0	21.3	40	13.5	40	573.0	40	38.8	40
1982 2 28 24 0	20.7	40	13.2	40	650.5	40	39.0	40

System 32

DATE 830425

ELECT. BACKUP KWH SOLAR PREHEAT KWH HOT WATER USAGE LITRES X SOLAR CNTR

DATE + TIME	169222131		169222132		169111133		169555132	
	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL
1982 7 1 24 0	2.2	40	10.8	40	213.5	40	82.8	40
1982 7 2 24 0	5.7	40	22.8	40	496.5	40	80.0	40
1982 7 3 24 0	5.0	40	1.4	40	82.0	40	22.4	40
1982 7 4 24 0	6.2	40	8.9	40	247.5	40	58.9	40
1982 7 5 24 0	3.5	40	2.0	40	53.5	40	36.2	40
1982 7 6 24 0	1.9	40	10.6	40	209.0	40	84.6	40
1982 7 7 24 0	2.4	40	7.2	40	137.0	40	74.9	40
1982 7 8 24 0	2.9	40	5.9	40	119.5	40	66.9	40
1982 7 9 24 0	3.9	40	12.4	40	267.0	40	76.1	40
1982 7 10 24 0	2.1	40	7.2	40	137.5	40	77.3	40
1982 7 11 24 0	2.3	40	6.6	40	139.5	40	73.9	40
1982 7 12 24 0	3.1	40	2.1	40	48.5	40	40.6	40
1982 7 13 24 0	2.5	40	2.0	40	39.0	40	45.3	40
1982 7 14 24 0	1.3	40	14.0	40	252.5	40	91.4	40
1982 7 15 24 0	2.7	40	9.0	40	183.0	40	76.5	40
1982 7 16 24 0	1.8	40	3.4	40	63.5	40	65.8	40
1982 7 17 24 0	1.8	40	5.6	40	109.5	40	76.0	40
1982 7 18 24 0	4.5	40	11.4	40	259.0	40	71.6	40
1982 7 19 24 0	2.9	40	1.6	40	42.5	40	35.4	40
1982 7 20 24 0	2.3	40	2.9	40	54.0	40	55.8	40
1982 7 21 24 0	1.4	40	3.7	40	60.5	40	72.2	40
1982 7 22 24 0	1.1	40	16.8	40	292.0	40	93.6	40
1982 7 23 24 0	2.4	40	4.0	40	84.0	40	63.0	40
1982 7 24 24 0	1.2	40	9.7	40	153.0	40	88.7	40
1982 7 25 24 0	2.3	40	10.0	40	199.0	40	81.5	40
1982 7 26 24 0	2.6	40	5.4	40	129.5	40	67.4	40
1982 7 27 24 0	3.0	40	6.3	40	133.5	40	67.7	40
1982 7 28 24 0	11.9	40	8.9	40	388.0	40	42.9	40
1982 7 29 24 0	2.1	40	.0	40	.0	40	.0	40
1982 7 30 24 0	1.7	40	2.7	40	44.5	40	61.8	40
1982 7 31 24 0	2.3	40	.0	40	.0	40	.0	40

System #3

ELECT. BACKUP KWH SOLAR PREHEAT KWH HOT WATER USAGE LITRES X SOLAR CNTR

DATE + TIME	169222241		169222242		169111143		169555542	
	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL
1981 2 1 24 0	21.4	40	6.6	40	405.0	40	23.6	40
1981 2 2 24 0	9.6	40	.7	40	110.5	40	7.0	40
1981 2 3 24 0	6.4	40	1.5	40	63.5	40	19.5	40
1981 2 4 24 0	12.2	40	6.2	40	212.0	40	33.8	40
1981 2 5 24 0	8.5	40	1.4	40	98.0	40	14.6	40
1981 2 6 24 0	5.6	40	1.0	40	53.5	40	15.0	40
1981 2 7 24 0	10.3	40	2.3	40	153.5	40	18.6	40
1981 2 8 24 0	18.0	40	5.6	40	276.5	40	23.8	40
1981 2 9 24 0	9.3	40	1.2	40	59.0	40	11.8	40
1981 2 10 24 0	8.9	40	1.3	40	50.5	40	13.0	40
1981 2 11 24 0	12.3	40	4.4	40	188.0	40	26.4	40
1981 2 12 24 0	17.2	40	7.5	40	252.0	40	30.5	40
1981 2 13 24 0	5.4	40	.3	40	13.5	40	6.1	40
1981 2 14 24 0	8.6	40	7.1	40	183.5	40	45.2	40
1981 2 15 24 0	12.0	40	6.9	40	229.0	40	36.7	40
1981 2 16 24 0	8.2	40	2.3	40	84.0	40	21.8	40
1981 2 17 24 0	9.1	40	2.0	40	84.0	40	17.9	40
1981 2 18 24 0	10.1	40	3.4	40	129.5	40	25.5	40
1981 2 19 24 0	11.5	40	4.7	40	205.0	40	29.3	40
1981 2 20 24 0	9.7	40	.8	40	35.5	40	8.1	40
1981 2 21 24 0	15.3	40	6.2	40	261.0	40	28.9	40
1981 2 22 24 0	13.1	40	4.3	40	187.5	40	25.0	40
1981 2 23 24 0	21.4	40	7.3	40	410.5	40	25.4	40
1981 2 24 24 0	14.0	40	4.4	40	179.5	40	23.8	40
1981 2 25 24 0	14.3	40	3.5	40	144.5	40	19.6	40
1981 2 26 24 0	6.9	40	3.4	40	79.5	40	32.8	40
1981 2 27 24 0	7.5	40	5.0	40	124.5	40	40.1	40
1981 2 28 24 0	8.0	40	3.2	40	111.5	40	28.5	40

System #3

DATE 830425

DATE + TIME	ELECT. BACKUP KWH 169222241		SOLAR PREHEAT KWH 169222242		HOT WATER USAGE LITRES X SOLAR CNTR 169111143		169555542	
	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL
1981 7 1 24 0	5.7	40	8.8	40	198.5	40	60.9	40
1981 7 2 24 0	3.9	40	1.9	40	47.0	40	33.2	40
1981 7 3 24 0	2.2	40	11.6	40	198.5	40	84.3	40
1981 7 4 24 0	2.8	40	1.6	40	45.0	40	36.2	40
1981 7 5 24 0	8.4	40	10.1	40	308.5	40	54.7	40
1981 7 6 24 0	3.4	40	4.3	40	81.5	40	56.1	40
1981 7 7 24 0	1.9	40	1.9	40	34.0	40	50.6	40
1981 7 8 24 0	1.3	40	14.5	40	267.5	40	91.5	40
1981 7 9 24 0	2.3	40	10.4	40	194.5	40	81.9	40
1981 7 10 24 0	4.3	40	6.4	40	146.5	40	60.1	40
1981 7 11 24 0	1.4	40	.0	40	.0	40	.0	40
1981 7 12 24 0	2.1	40	.0	40	.0	40	.0	40
1981 7 13 24 0	1.4	40	.0	40	.0	40	.0	40
1981 7 14 24 0	2.1	40	.0	40	.0	40	.0	40
1981 7 15 24 0	2.0	40	.0	40	.0	40	.0	40
1981 7 16 24 0	1.6	40	.0	40	.0	40	.0	40
1981 7 17 24 0	2.2	40	.0	40	.0	40	.0	40
1981 7 18 24 0	1.5	40	.0	40	.0	40	.0	40
1981 7 19 24 0	2.1	40	.0	40	.0	40	.0	40
1981 7 20 24 0	1.5	40	.0	40	.0	40	.0	40
1981 7 21 24 0	1.6	40	.0	40	.0	40	.0	40
1981 7 22 24 0	2.1	40	.0	40	.0	40	.0	40
1981 7 23 24 0	2.3	40	.0	40	.0	40	.0	40
1981 7 24 24 0	1.5	40	.0	40	.0	40	.0	40
1981 7 25 24 0	3.2	40	6.7	40	147.0	40	67.7	40
1981 7 26 24 0	11.1	40	6.3	40	274.0	40	36.2	40
1981 7 27 24 0	4.6	40	1.5	40	46.0	40	25.4	40
1981 7 28 24 0	8.8	40	3.9	40	196.5	40	31.1	40
1981 7 29 24 0	5.4	40	1.1	40	35.5	40	16.8	40
1981 7 30 24 0	2.7	40	4.7	40	94.5	40	64.0	40
1981 7 31 24 0	2.8	40	5.4	40	114.5	40	66.2	40

System #5

DATE 830425

DATE + TIME	ELECT. BACKUP KWH 169222241		SOLAR PREHEAT KWH 169222242		HOT WATER USAGE LITRES 169111143		X SOLAR CNTR 169555542	
	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL
1982 2 1 24 0	13.0	40	3.5	40	117.0	40	21.5	40
1982 2 2 24 0	10.0	40	6.0	40	240.0	40	37.7	40
1982 2 3 24 0	13.0	40	1.0	40	38.5	40	7.2	40
1982 2 4 24 0	16.0	40	5.8	40	245.5	40	26.7	40
1982 2 5 24 0	8.8	40	1.6	40	52.5	40	15.2	40
1982 2 6 24 0	8.0	40	.6	40	23.5	40	6.7	40
1982 2 7 24 0	15.9	40	4.8	40	228.0	40	23.1	40
1982 2 8 24 0	25.4	40	10.5	40	564.0	40	29.2	40
1982 2 9 24 0	18.9	40	3.7	40	155.0	40	16.5	40
1982 2 10 24 0	9.2	40	2.0	40	70.0	40	17.9	40
1982 2 11 24 0	10.2	40	2.6	40	88.5	40	20.2	40
1982 2 12 24 0	7.6	40	.6	40	26.0	40	7.9	40
1982 2 13 24 0	21.8	40	14.0	40	522.0	40	39.2	40
1982 2 14 24 0	22.3	40	8.5	40	351.5	40	27.6	40
1982 2 15 24 0	7.8	40	1.7	40	52.5	40	18.2	40
1982 2 16 24 0	6.4	40	1.6	40	46.5	40	20.5	40
1982 2 17 24 0	12.5	40	12.1	40	307.5	40	49.2	40
1982 2 18 24 0	7.6	40	1.7	40	55.0	40	18.3	40
1982 2 19 24 0	12.3	40	5.6	40	185.0	40	31.2	40
1982 2 20 24 0	19.1	40	6.9	40	308.0	40	26.6	40
1982 2 21 24 0	34.8	40	8.2	40	625.0	40	19.0	40
1982 2 22 24 0	12.3	40	1.8	40	89.5	40	12.7	40
1982 2 23 24 0	16.8	40	7.3	40	303.0	40	30.4	40
1982 2 24 24 0	12.3	40	4.3	40	163.0	40	26.0	40
1982 2 25 24 0	10.9	40	4.1	40	104.5	40	27.3	40
1982 2 26 24 0	8.2	40	4.0	40	105.5	40	32.9	40
1982 2 27 24 0	11.1	40	15.5	40	348.0	40	58.1	40
1982 2 28 24 0	21.4	40	15.4	40	512.5	40	41.9	40

System 63

DATE 830425

ELECT. BACKUP KWH SOLAR PREHEAT KWH HOT WATER USAGE LITRES % SOLAR CNTR

DATE + TIME	169222241		169222242		169111143		169555542	
	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL
1982 7 1 24 0	2.9	40	.0	40	.0	40	.0	40
1982 7 2 24 0	2.4	40	6.9	40	106.0	40	74.2	40
1982 7 3 24 0	5.5	40	5.4	40	144.0	40	49.5	40
1982 7 4 24 0	3.7	40	13.5	40	253.0	40	78.6	40
1982 7 5 24 0	5.1	40	5.3	40	117.0	40	51.0	40
1982 7 6 24 0	2.5	40	2.4	40	45.5	40	49.3	40
1982 7 7 24 0	2.7	38	11.9	38	219.5	38	81.6	38
1982 7 8 24 0	2.9	40	2.6	40	58.0	40	47.1	40
1982 7 9 24 0	3.3	40	5.1	40	111.5	40	61.0	40
1982 7 10 24 0	.0	40	13.6	40	267.0	40	100.0	40
1982 7 11 24 0	9.8	40	16.4	40	435.5	40	62.5	40
1982 7 12 24 0	3.6	40	2.1	40	47.0	40	36.6	40
1982 7 13 24 0	3.4	40	12.3	40	225.0	40	78.1	40
1982 7 14 24 0	2.2	40	6.4	40	107.0	40	74.5	40
1982 7 15 24 0	3.1	40	9.5	40	180.0	40	75.6	40
1982 7 16 24 0	2.7	40	7.6	40	139.0	40	74.1	40
1982 7 17 24 0	3.0	40	.0	40	.0	40	.0	40
1982 7 18 24 0	3.9	40	20.7	40	377.0	40	84.1	40
1982 7 19 24 0	4.7	40	1.8	40	50.0	40	27.3	40
1982 7 20 24 0	2.4	40	5.6	40	96.5	40	69.9	40
1982 7 21 24 0	2.2	40	12.7	40	212.0	40	85.0	40
1982 7 22 24 0	2.6	40	6.6	40	126.5	40	71.7	40
1982 7 23 24 0	2.3	40	4.2	40	73.5	40	64.3	40
1982 7 24 24 0	2.2	40	6.7	40	117.0	40	75.2	40
1982 7 25 24 0	4.6	40	10.1	40	232.5	40	68.6	40
1982 7 26 24 0	4.1	40	10.2	40	206.5	40	71.3	40
1982 7 27 24 0	7.2	40	4.8	40	156.5	40	40.0	40
1982 7 28 24 0	7.5	40	2.6	40	98.0	40	26.1	40
1982 7 29 24 0	3.2	40	11.0	40	214.5	40	77.5	40
1982 7 30 24 0	4.7	40	5.4	40	130.5	40	53.3	40
1982 7 31 24 0	2.7	40	.0	40	.0	40	.0	40

System 64

DATE 830615

DATE + TIME	ELECT. BACKUP KWH 169222101		SOLAR PREHEAT KWH 169222102		HOT WATER USAGE LITRES 169111103		% SOLAR CNTR 169555102	
	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL
1981 2 1 24 0	27.1	40	2.6	40	489.0	40	8.7	40
1981 2 2 24 0	20.1	40	1.2	40	290.5	40	5.5	40
1981 2 3 24 0	20.8	40	4.7	40	430.5	40	18.6	40
1981 2 4 24 0	23.5	40	3.8	40	364.5	40	14.0	40
1981 2 5 24 0	19.7	40	4.3	40	406.0	40	17.9	40
1981 2 6 24 0	16.2	40	.7	40	201.5	40	4.4	40
1981 2 7 24 0	25.2	40	3.0	40	435.5	40	10.6	40
1981 2 8 24 0	27.2	40	2.5	40	449.5	40	8.5	40
1981 2 9 24 0	22.2	40	1.8	40	373.5	40	7.7	40
1981 2 10 24 0	16.8	40	.7	40	247.0	40	3.9	40
1981 2 11 24 0	22.6	40	1.3	40	363.5	40	5.6	40
1981 2 12 24 0	19.3	40	.7	40	293.0	40	3.5	40
1981 2 13 24 0	19.9	40	1.0	40	322.0	40	5.0	40
1981 2 14 24 0	19.7	40	5.4	40	403.0	40	21.5	40
1981 2 15 24 0	23.0	40	1.9	40	393.5	40	7.5	40
1981 2 16 24 0	22.3	40	.9	40	309.0	40	3.8	40
1981 2 17 24 0	27.8	40	1.5	40	459.0	40	5.2	40
1981 2 18 24 0	24.7	40	1.1	40	335.0	40	4.3	40
1981 2 19 24 0	20.1	40	1.0	40	327.0	40	4.9	40
1981 2 20 24 0	23.7	40	1.3	40	474.0	40	5.8	40
1981 2 21 24 0	23.2	40	2.6	40	489.0	40	8.4	40
1981 2 22 24 0	26.5	40	3.1	40	463.5	40	10.4	40
1981 2 23 24 0	21.6	40	1.3	40	357.5	40	5.8	40
1981 2 24 24 0	24.3	40	2.5	40	423.5	40	9.4	40
1981 2 25 24 0	27.1	40	2.8	40	481.0	40	9.3	40
1981 2 26 24 0	22.3	40	10.5	40	502.5	40	32.1	40
1981 2 27 24 0	27.5	40	10.3	40	618.5	40	27.3	40
1981 2 28 24 0	20.2	40	2.4	40	350.5	40	10.7	40

System #1

DATE 830425

ELECT. BACKUP KWH SOLAR PREHEAT KWH HOT WATER USAGE LITRES X SOLAR CNTR

DATE + TIME	169222101		169222102		169111103		169555102	
	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL
1981 7 1 24 0	10.0	40	10.4	40	340.0	40	51.2	40
1981 7 2 24 0	4.4	40	9.1	40	214.5	40	67.3	40
1981 7 3 24 0	2.3	40	11.6	40	223.5	40	83.3	40
1981 7 4 24 0	6.3	40	15.0	40	364.0	40	70.5	40
1981 7 5 24 0	9.6	40	5.4	40	255.5	40	36.2	40
1981 7 6 24 0	2.5	40	12.2	40	223.5	40	83.2	40
1981 7 7 24 0	1.8	40	14.7	40	237.5	40	83.2	40
1981 7 8 24 0	1.3	40	8.8	40	160.0	40	87.1	40
1981 7 9 24 0	2.4	40	13.7	40	257.5	40	85.2	40
1981 7 10 24 0	2.2	40	12.3	40	229.5	40	84.6	40
1981 7 11 24 0	3.2	40	19.6	40	383.0	40	86.1	40
1981 7 12 24 0	9.6	40	9.5	40	325.5	40	49.6	40
1981 7 13 24 0	3.3	40	12.2	40	253.5	40	78.4	40
1981 7 14 24 0	2.6	40	9.3	40	180.5	40	78.0	40
1981 7 15 24 0	2.1	40	16.1	40	275.5	40	88.3	40
1981 7 16 24 0	4.3	40	8.3	40	201.5	40	65.7	40
1981 7 17 24 0	4.0	40	9.6	40	212.0	40	70.4	40
1981 7 18 24 0	9.3	40	14.1	40	413.0	40	60.3	40
1981 7 19 24 0	10.5	40	11.8	40	399.0	40	53.0	40
1981 7 20 24 0	10.8	40	1.9	40	220.0	40	15.2	40
1981 7 21 24 0	7.1	40	5.8	40	216.0	40	44.9	40
1981 7 22 24 0	3.6	40	11.4	40	239.5	40	76.0	40
1981 7 23 24 0	3.5	40	14.3	40	291.5	40	80.4	40
1981 7 24 24 0	5.2	40	8.3	40	212.0	40	61.7	40
1981 7 25 24 0	7.3	40	7.2	40	248.0	40	49.7	40
1981 7 26 24 0	17.3	40	8.3	40	477.5	40	32.4	40
1981 7 27 24 0	6.5	40	7.7	40	242.5	40	54.1	40
1981 7 28 24 0	10.6	40	3.9	40	277.5	40	26.8	40
1981 7 29 24 0	8.5	40	9.0	40	316.0	40	51.4	40
1981 7 30 24 0	5.0	40	12.0	40	313.5	40	70.7	40
1981 7 31 24 0	2.6	40	9.3	40	192.0	40	78.2	40

System #1

DATE 830425

DATE + TIME	ELECT. BACKUP KWH 169222101		SOLAR PREHEAT KWH 169222102		HOT WATER USAGE LITRES X SOLAR CNTR 169111103		169555102	
	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL
1982 2 1 24 0	11.1	40	.3	40	242.5	40	3.0	40
1982 2 2 24 0	13.4	40	.8	40	263.5	40	5.8	40
1982 2 3 24 0	13.7	40	1.0	40	272.5	40	7.0	40
1982 2 4 24 0	15.2	40	1.5	40	353.0	40	9.0	40
1982 2 5 24 0	18.7	40	.5	40	265.0	40	2.9	40
1982 2 6 24 0	20.7	40	1.0	40	349.0	40	4.5	40
1982 2 7 24 0	28.4	40	1.3	40	476.5	40	4.5	40
1982 2 8 24 0	13.0	40	.6	40	204.0	40	4.4	40
1982 2 9 24 0	20.6	40	1.2	40	391.5	40	5.6	40
1982 2 10 24 0	22.1	40	1.4	40	414.0	40	6.0	40
1982 2 11 24 0	18.4	40	.7	40	277.5	40	3.7	40
1982 2 12 24 0	12.3	40	.5	40	189.5	40	4.3	40
1982 2 13 24 0	14.3	40	.7	40	226.0	40	5.0	40
1982 2 14 24 0	33.6	40	2.0	40	629.5	40	5.7	40
1982 2 15 24 0	13.9	40	1.0	40	252.0	40	6.7	40
1982 2 16 24 0	11.6	40	2.0	40	240.5	40	14.5	40
1982 2 17 24 0	14.7	40	5.0	40	330.0	40	25.2	40
1982 2 18 24 0	15.6	40	2.8	40	280.5	40	15.4	40
1982 2 19 24 0	12.9	40	1.0	40	229.0	40	7.3	40
1982 2 20 24 0	21.7	40	1.3	40	401.5	40	5.7	40
1982 2 21 24 0	30.4	40	2.0	40	587.5	40	6.1	40
1982 2 22 24 0	16.4	40	1.5	40	284.0	40	8.3	40
1982 2 23 24 0	15.7	40	1.2	40	318.5	40	7.2	40
1982 2 24 24 0	18.4	40	1.6	40	329.0	40	8.2	40
1982 2 25 24 0	12.2	40	7.5	40	300.5	40	38.0	40
1982 2 26 24 0	8.2	40	4.8	40	198.0	40	37.2	40
1982 2 27 24 0	14.6	40	12.8	40	463.5	40	46.7	40
1982 2 28 24 0	18.0	40	8.7	40	447.5	40	32.6	40

System #4

DATE 830425

ELECT. BACKUP KWH / SOLAR PREHEAT KWH HOT WATER USAGE LITRES X SOLAR CNTR

DATE + TIME	169222101 VALUE	QUAL	169222102 VALUE	QUAL	169111103 VALUE	QUAL	169555102 VALUE	QUAL
1982 7 1 24 0	3.1	40	17.0	40	322.5	40	84.7	40
1982 7 2 24 0	3.6	40	11.5	40	236.5	40	76.0	40
1982 7 3 24 0	10.8	40	9.5	40	356.0	40	46.9	40
1982 7 4 24 0	9.9	40	12.4	40	390.0	40	55.6	40
1982 7 5 24 0	2.7	40	13.5	40	251.5	40	83.4	40
1982 7 6 24 0	3.0	40	10.5	40	207.0	40	78.0	40
1982 7 7 24 0	2.6	40	14.8	40	271.5	40	85.2	40
1982 7 8 24 0	3.5	40	8.5	40	183.0	40	70.6	40
1982 7 9 24 0	3.3	40	11.1	40	219.5	40	77.4	40
1982 7 10 24 0	2.4	40	16.8	40	321.5	40	87.3	40
1982 7 11 24 0	11.3	40	11.0	40	389.0	40	49.5	40
1982 7 12 24 0	3.0	40	7.4	40	159.5	40	71.1	40
1982 7 13 24 0	2.9	40	13.3	40	232.0	40	82.2	40
1982 7 14 24 0	2.2	40	11.0	40	203.5	40	83.5	40
1982 7 15 24 0	2.6	40	15.7	40	283.5	40	85.9	40
1982 7 16 24 0	3.2	40	6.8	40	139.5	40	68.2	40
1982 7 17 24 0	6.4	40	9.5	40	259.5	40	59.5	40
1982 7 18 24 0	9.2	40	15.3	40	437.0	40	62.5	40
1982 7 19 24 0	3.8	40	6.9	40	161.5	40	64.7	40
1982 7 20 24 0	2.2	40	10.6	40	207.0	40	82.8	40
1982 7 21 24 0	2.8	40	15.8	40	297.5	40	84.8	40
1982 7 22 24 0	2.2	40	11.5	40	220.5	40	83.8	40
1982 7 23 24 0	3.2	40	1.6	40	50.5	40	34.1	40
1982 7 24 24 0	2.1	40	.0	40	.0	40	.0	40
1982 7 25 24 0	1.6	40	9.4	40	156.5	40	85.5	40
1982 7 26 24 0	2.5	40	17.3	40	333.5	40	87.2	40
1982 7 27 24 0	6.8	40	5.0	40	256.5	40	42.5	40
1982 7 28 24 0	8.4	40	7.1	40	336.0	40	45.6	40
1982 7 29 24 0	3.6	40	9.4	40	264.5	40	72.4	40
1982 7 30 24 0	5.5	40	13.8	40	362.0	40	71.6	40
1982 7 31 24 0	8.2	40	10.4	40	374.0	40	56.1	40

System #5

DATE 830425

DATE + TIME	ELECT. BACKUP KWH 169222161		SOLAR PREHEAT KWH 169222162		HOT WATER USAGE LITRES 169111163		% SOLAR CNTR 169555162	
	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL
1981 2 1 24 0	11.9	40	1.4	40	92.0	40	10.4	40
1981 2 2 24 0	22.1	40	1.6	40	274.0	40	6.7	40
1981 2 3 24 0	20.6	40	3.9	40	336.0	40	15.9	40
1981 2 4 24 0	13.6	40	1.9	40	212.5	40	12.4	40
1981 2 5 24 0	20.7	40	3.5	40	332.0	40	14.5	40
1981 2 6 24 0	20.3	40	1.5	40	312.0	40	7.0	40
1981 2 7 24 0	32.6	40	2.9	40	513.0	40	8.2	40
1981 2 8 24 0	19.4	40	1.1	40	281.0	40	5.6	40
1981 2 9 24 0	19.4	40	1.4	40	298.0	40	6.6	40
1981 2 10 24 0	17.4	40	1.2	40	246.5	40	6.3	40
1981 2 11 24 0	14.0	40	.9	40	203.0	40	6.2	40
1981 2 12 24 0	16.1	40	3.4	40	274.5	40	17.3	40
1981 2 13 24 0	19.4	40	5.8	40	364.0	40	23.2	40
1981 2 14 24 0	22.5	40	1.8	40	334.0	40	7.4	40
1981 2 15 24 0	16.6	40	.8	40	232.0	40	4.7	40
1981 2 16 24 0	16.7	40	1.3	40	259.5	40	7.2	40
1981 2 17 24 0	19.3	40	1.4	40	282.5	40	6.9	40
1981 2 18 24 0	21.1	40	1.6	40	323.5	40	7.3	40
1981 2 19 24 0	16.4	40	.8	40	214.5	40	4.8	40
1981 2 20 24 0	17.1	40	1.5	40	262.5	40	8.1	40
1981 2 21 24 0	16.6	40	2.0	40	257.0	40	10.9	40
1981 2 22 24 0	23.4	40	3.5	40	413.5	40	13.0	40
1981 2 23 24 0	15.1	40	.6	40	223.0	40	4.0	40
1981 2 24 24 0	11.8	40	.8	40	158.0	40	6.3	40
1981 2 25 24 0	14.7	40	1.4	40	226.0	40	8.7	40
1981 2 26 24 0	19.9	40	2.6	40	325.0	40	11.4	40
1981 2 27 24 0	15.5	40	5.1	40	291.5	40	24.9	40
1981 2 28 24 0	19.4	40	4.3	40	339.5	40	18.1	40

System #4

DATE 830425

DATE + TIME	ELECT. BACKUP KWH 169222161		SOLAR PREHEAT KWH 169222162		HOT WATER USAGE LITRES 169111163		% SOLAR CNTR 169555162	
	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL	VALUE	QUAL
1981 7 1 24 0	7.2	40	12.3	40	272.5	40	63.2	40
1981 7 2 24 0	5.4	40	5.1	40	156.0	40	48.4	40
1981 7 3 24 0	3.9	40	10.0	40	197.5	40	71.8	40
1981 7 4 24 0	3.2	40	7.5	40	163.0	40	70.4	40
1981 7 5 24 0	4.6	40	7.6	40	181.5	40	62.2	40
1981 7 6 24 0	3.1	40	11.8	40	252.0	40	79.1	40
1981 7 7 24 0	3.1	40	10.4	40	222.0	40	77.2	40
1981 7 8 24 0	1.6	40	10.3	40	189.0	40	86.9	40
1981 7 9 24 0	3.0	40	7.1	40	142.5	40	70.2	40
1981 7 10 24 0	3.1	40	6.3	40	123.5	40	67.2	40
1981 7 11 24 0	1.6	40	13.6	40	208.0	40	89.5	40
1981 7 12 24 0	3.0	40	12.1	40	237.0	40	79.9	40
1981 7 13 24 0	3.2	40	11.5	40	246.5	40	77.9	40
1981 7 14 24 0	3.9	40	11.2	40	208.5	40	74.1	40
1981 7 15 24 0	3.9	40	14.4	40	261.0	40	78.6	40
1981 7 16 24 0	2.9	40	10.3	40	209.5	40	78.4	40
1981 7 17 24 0	2.8	40	9.9	40	173.5	40	77.6	40
1981 7 18 24 0	5.9	40	14.4	40	294.5	40	70.8	40
1981 7 19 24 0	8.3	40	7.3	40	233.0	40	47.0	40
1981 7 20 24 0	6.9	40	4.0	40	160.0	40	36.9	40
1981 7 21 24 0	7.1	40	4.0	40	165.5	40	36.1	40
1981 7 22 24 0	4.4	40	11.7	40	241.0	40	72.5	40
1981 7 23 24 0	3.6	40	10.5	40	232.5	40	74.3	40
1981 7 24 24 0	3.7	40	10.8	40	213.5	40	74.7	40
1981 7 25 24 0	3.8	40	3.1	40	86.0	40	44.4	40
1981 7 26 24 0	7.1	40	6.0	40	191.5	40	46.1	40
1981 7 27 24 0	5.4	40	10.3	40	275.0	40	65.4	40
1981 7 28 24 0	7.6	40	2.6	40	152.0	40	25.6	40
1981 7 29 24 0	7.3	40	4.5	40	193.0	40	38.4	40
1981 7 30 24 0	4.5	40	11.2	40	285.0	40	71.3	40
1981 7 31 24 0	2.9	40	8.2	40	159.0	40	74.1	40

System B5

DATE 830425

DATE	#	TIME	ELECT. BACKUP KWH 169222161 VALUE	QUAL	SOLAR PREHEAT KWH 169222162 VALUE	QUAL	HOT WATER USAGE LITRES 169111163 VALUE	QUAL	X SOLAR CNTR 169555162 VALUE	QUAL
1982	2	1 24 0	23.4	40	1.6	40	322.0	40	6.3	40
1982	2	2 24 0	12.3	40	.6	40	139.5	40	4.5	40
1982	2	3 24 0	21.3	40	2.2	40	350.5	40	9.3	40
1982	2	4 24 0	16.5	40	.8	40	200.5	40	4.6	40
1982	2	5 24 0	21.3	40	1.4	40	289.5	40	6.4	40
1982	2	6 24 0	12.7	40	1.0	40	152.5	40	7.1	40
1982	2	7 24 0	12.9	40	.8	40	155.0	40	5.7	40
1982	2	8 24 0	11.1	40	.9	40	126.5	40	7.3	40
1982	2	9 24 0	25.4	40	2.4	40	358.0	40	8.8	40
1982	2	10 24 0	23.0	40	1.4	40	324.0	40	5.7	40
1982	2	11 24 0	19.2	40	1.9	40	350.0	40	8.9	40
1982	2	12 24 0	27.9	40	1.3	40	366.0	40	4.5	40
1982	2	13 24 0	30.4	40	1.9	40	519.0	40	5.9	40
1982	2	14 24 0	26.5	40	1.1	40	363.0	40	4.2	40
1982	2	15 24 0	20.1	40	2.2	40	289.0	40	9.8	40
1982	2	16 24 0	16.7	40	4.6	40	271.0	40	21.6	40
1982	2	17 24 0	18.4	40	7.6	40	351.0	40	29.4	40
1982	2	18 24 0	10.9	40	1.1	40	123.5	40	9.1	40
1982	2	19 24 0	17.5	40	3.0	40	277.5	40	14.7	40
1982	2	20 24 0	16.6	40	1.5	40	192.5	40	8.5	40
1982	2	21 24 0	20.8	40	2.2	40	283.5	40	9.8	40
1982	2	22 24 0	14.1	40	1.0	40	165.5	40	6.9	40
1982	2	23 24 0	16.6	40	2.4	40	249.0	40	12.8	40
1982	2	24 24 0	12.4	40	1.1	40	151.0	40	8.5	40
1982	2	25 24 0	20.7	40	12.4	40	391.0	40	37.4	40
1982	2	26 24 0	22.2	40	8.5	40	240.0	40	27.7	40
1982	2	27 24 0	13.7	40	8.6	40	290.0	40	38.5	40
1982	2	28 24 0	15.9	40	12.8	40	334.0	40	44.7	40

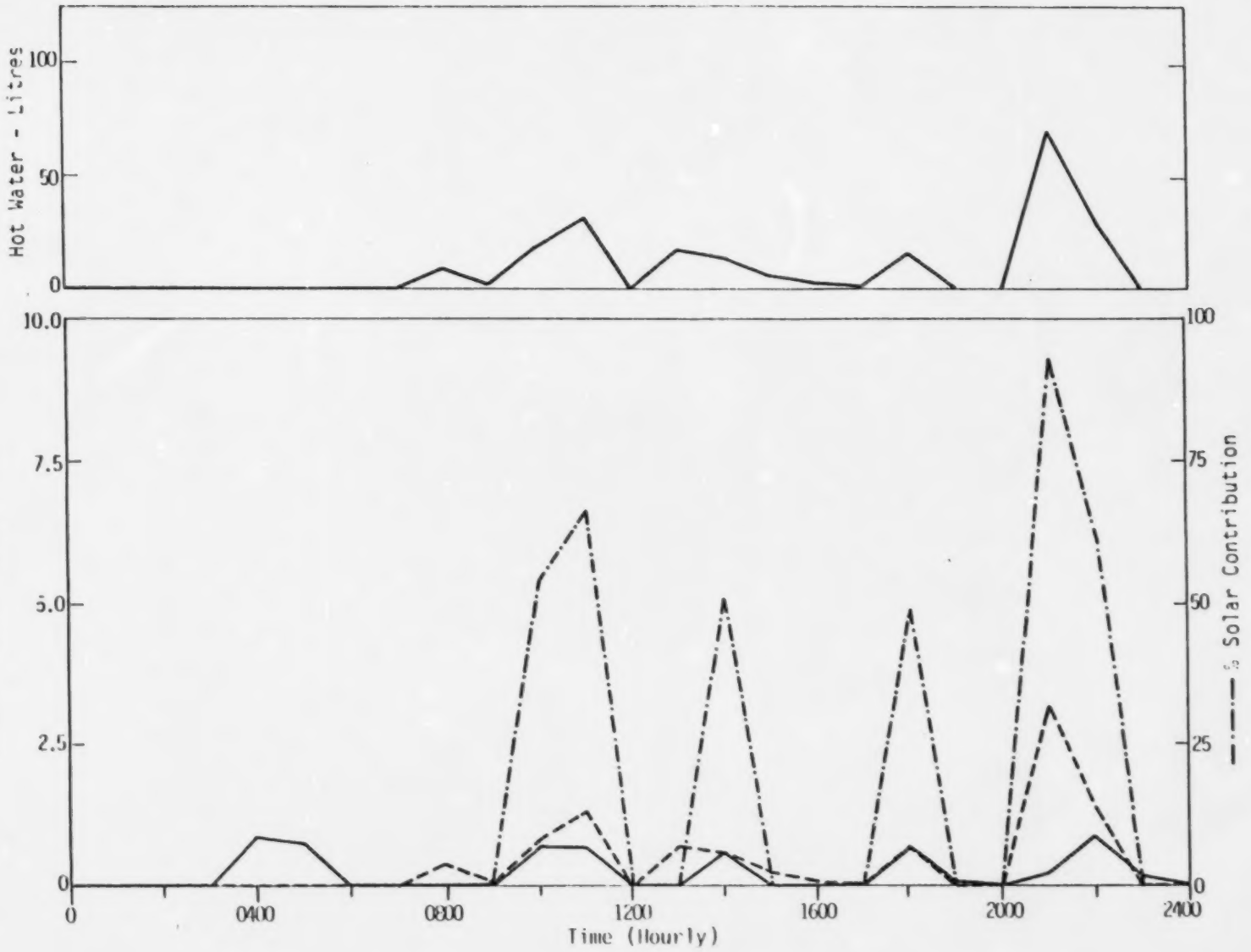
System #5

DATE 830425

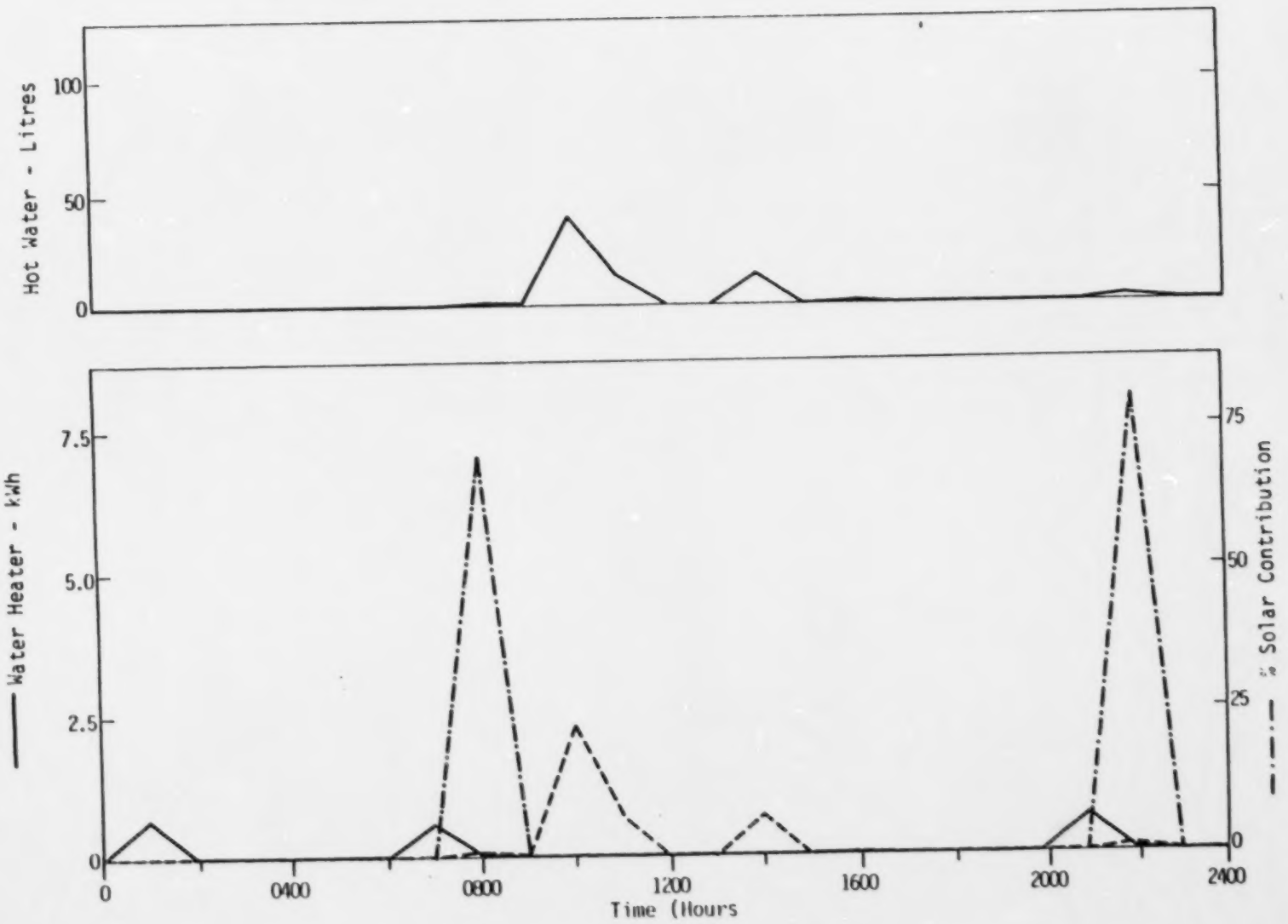
DATE + TIME	ELECT. BACKUP KWH 169222161 VALUE	QUAL	SOLAR PREHEAT KWH 169222162 VALUE	QUAL	HOT WATER USAGE LITRES 169111163 VALUE	QUAL	X SOLAR CNTR 169555162 VALUE	QUAL
1982 7 1 24 0	3.8	40	20.6	40	390.5	40	84.5	40
1982 7 2 24 0	7.9	40	18.1	40	411.5	40	69.5	40
1982 7 3 24 0	5.3	40	2.9	40	112.0	40	35.9	40
1982 7 4 24 0	5.0	40	16.2	40	336.5	40	76.6	40
1982 7 5 24 0	2.9	40	3.6	40	96.0	40	55.3	40
1982 7 6 24 0	3.0	40	11.3	40	205.0	40	78.9	40
1982 7 7 24 0	2.5	40	5.6	40	115.5	40	68.8	40
1982 7 8 24 0	2.1	40	11.5	40	208.5	40	84.6	40
1982 7 9 24 0	4.0	40	5.1	40	110.0	40	56.0	40
1982 7 10 24 0	2.5	40	15.2	40	292.0	40	85.8	40
1982 7 11 24 0	4.3	40	5.6	40	211.0	40	68.9	40
1982 7 12 24 0	2.9	40	12.1	40	236.0	40	80.5	40
1982 7 13 24 0	5.6	40	8.5	40	199.0	40	60.5	40
1982 7 14 24 0	2.0	40	3.9	40	84.0	40	66.0	40
1982 7 15 24 0	2.2	40	6.0	40	108.5	40	73.0	40
1982 7 16 24 0	1.2	40	11.5	40	188.5	40	90.8	40
1982 7 17 24 0	4.2	40	9.4	40	207.0	40	69.1	40
1982 7 18 24 0	3.3	40	9.0	40	188.5	40	73.0	40
1982 7 19 24 0	3.0	40	4.7	40	115.0	40	61.0	40
1982 7 20 24 0	2.5	40	9.7	40	197.0	40	79.3	40
1982 7 21 24 0	2.3	40	14.5	40	241.0	40	86.5	40
1982 7 22 24 0	1.0	40	11.7	40	222.5	40	92.0	40
1982 7 23 24 0	8.5	40	15.3	40	368.0	40	64.2	40
1982 7 24 24 0	3.1	40	4.2	40	92.0	40	57.9	40
1982 7 25 24 0	3.4	40	18.5	40	366.0	40	84.3	40
1982 7 26 24 0	3.5	40	9.8	40	209.5	40	73.7	40
1982 7 27 24 0	8.4	40	5.9	40	226.0	40	41.2	40
1982 7 28 24 0	10.4	40	7.2	40	283.0	40	41.0	40
1982 7 29 24 0	5.3	40	4.0	40	130.5	40	43.0	40
1982 7 30 24 0	1.0	40	12.8	40	245.5	40	92.6	40
1982 7 31 24 0	3.5	40	3.0	40	75.5	40	46.2	40

APPENDIX D

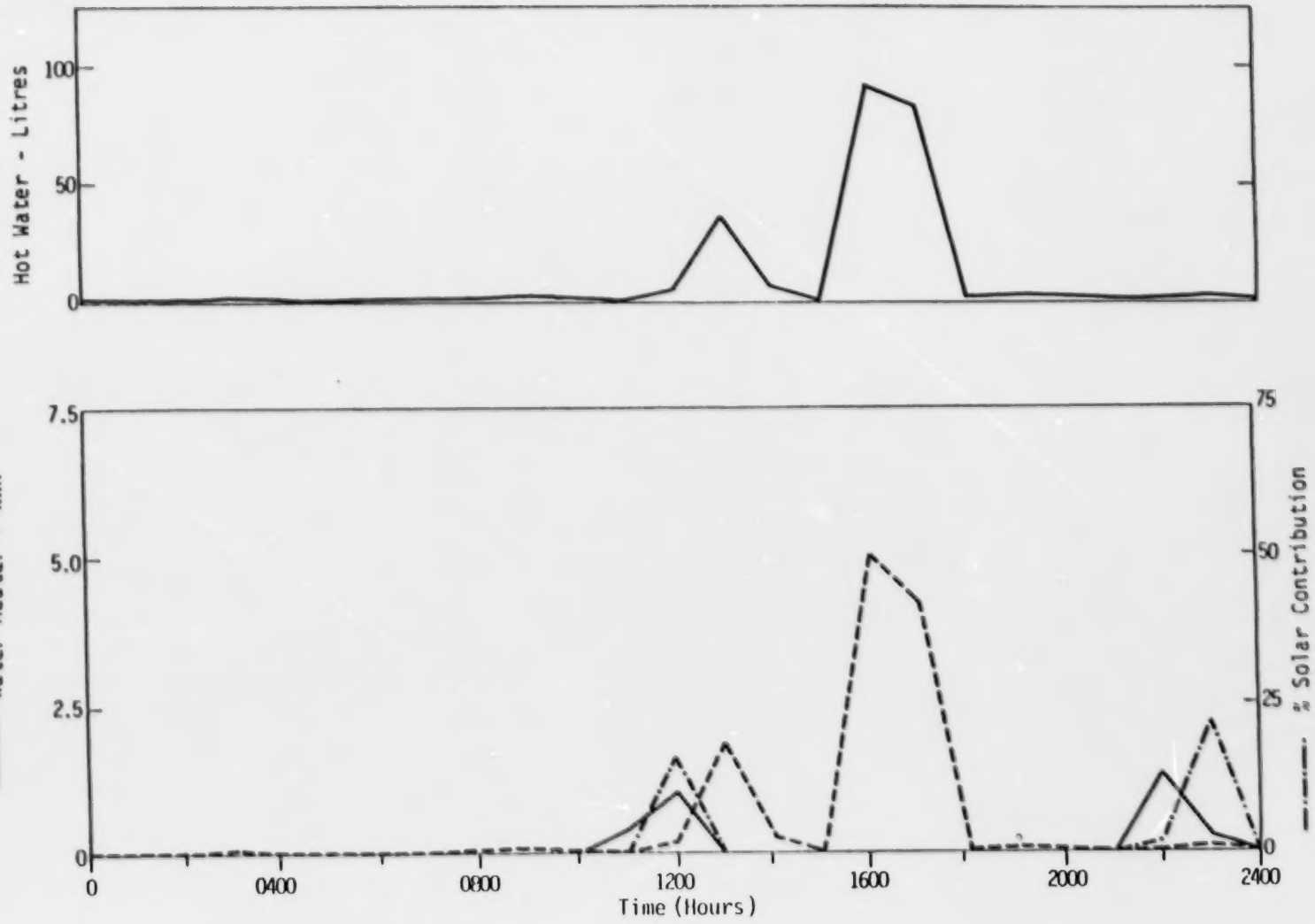
TYPICAL HOURLY, DAILY, AND
MONTHLY PERFORMANCE PROFILES
(STS - COMPUTER PRINTOUTS PLOTS)



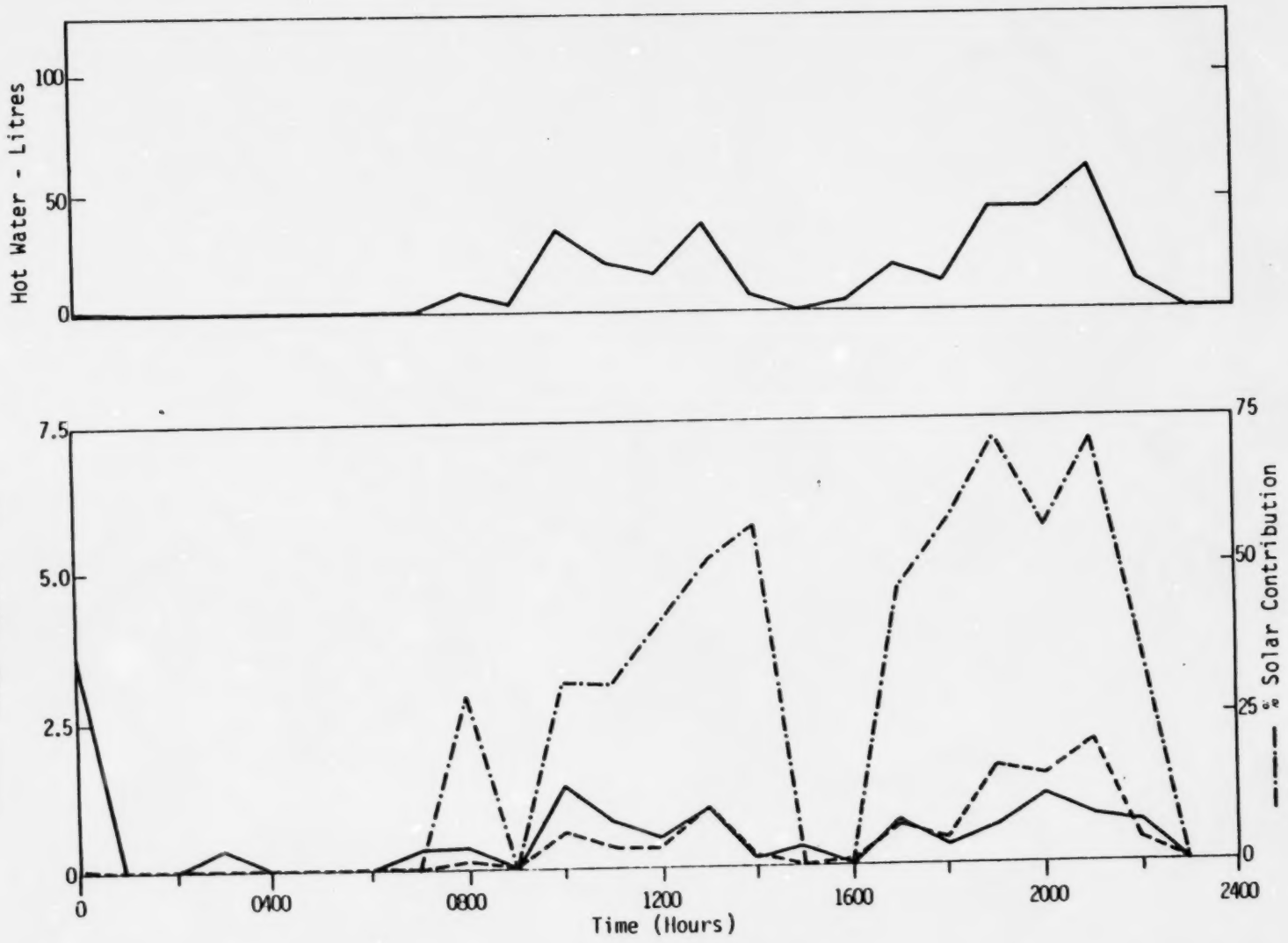
SYSTEM 1 - HOURLY DATA - JULY 12, 1981



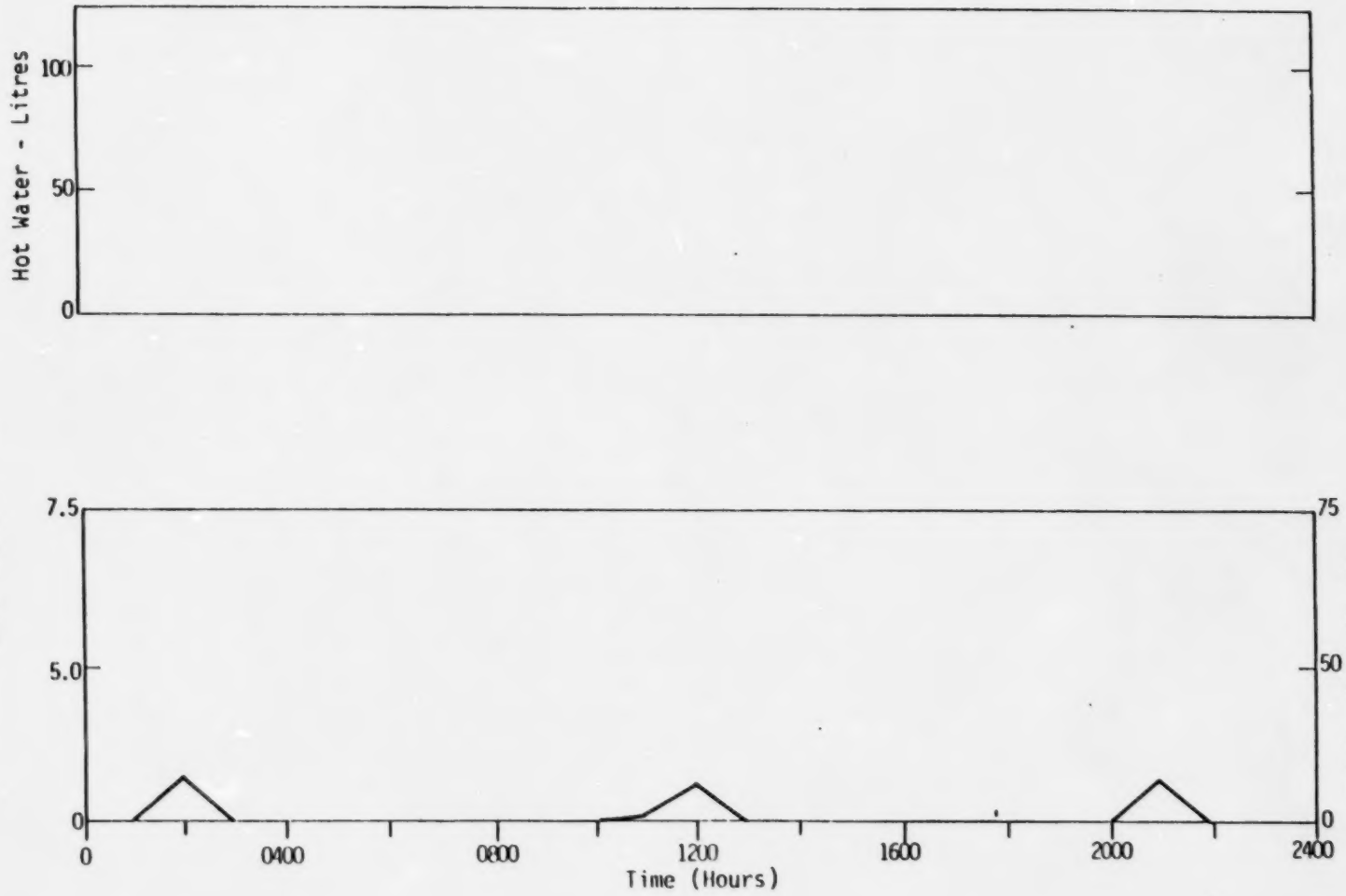
SYSTEM 2 - HOURLY DATA - JULY 12, 1981



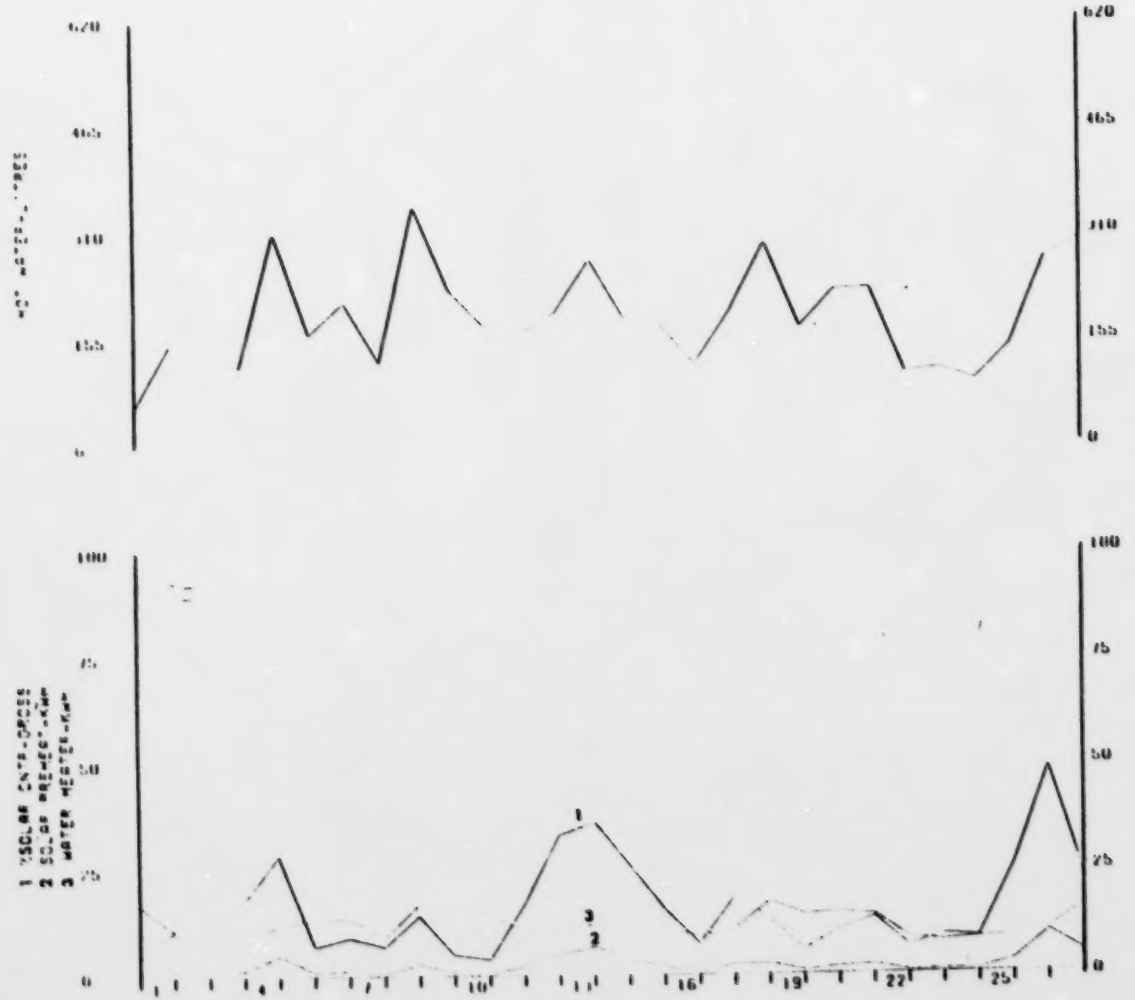
SYSTEM 3 - HOURLY DATA - JULY 12, 1981



SYSTEM 4 - HOURLY DATA - JULY 12, 1981

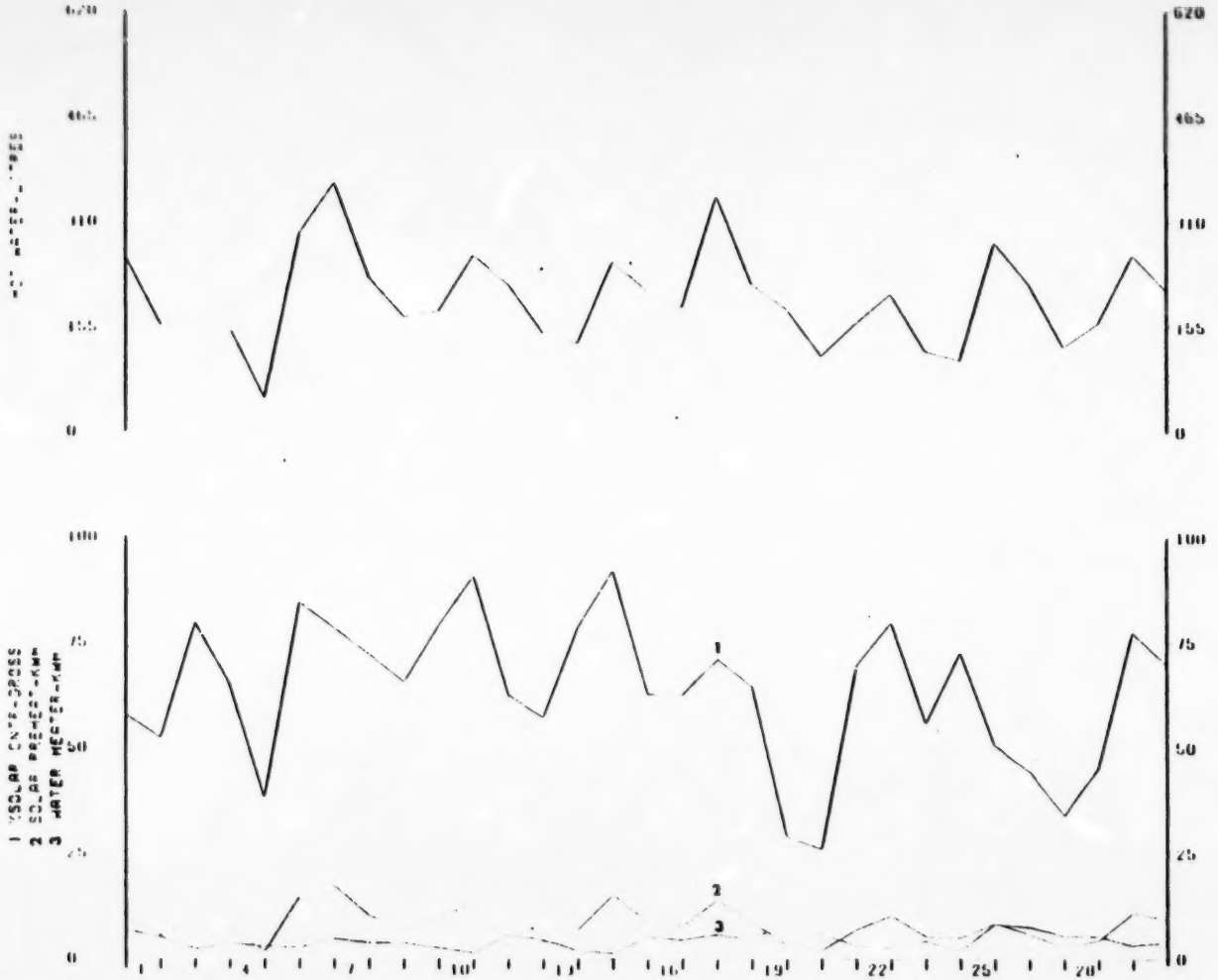


SYSTEM 5 - HOURLY DATA - JULY 12, 1981



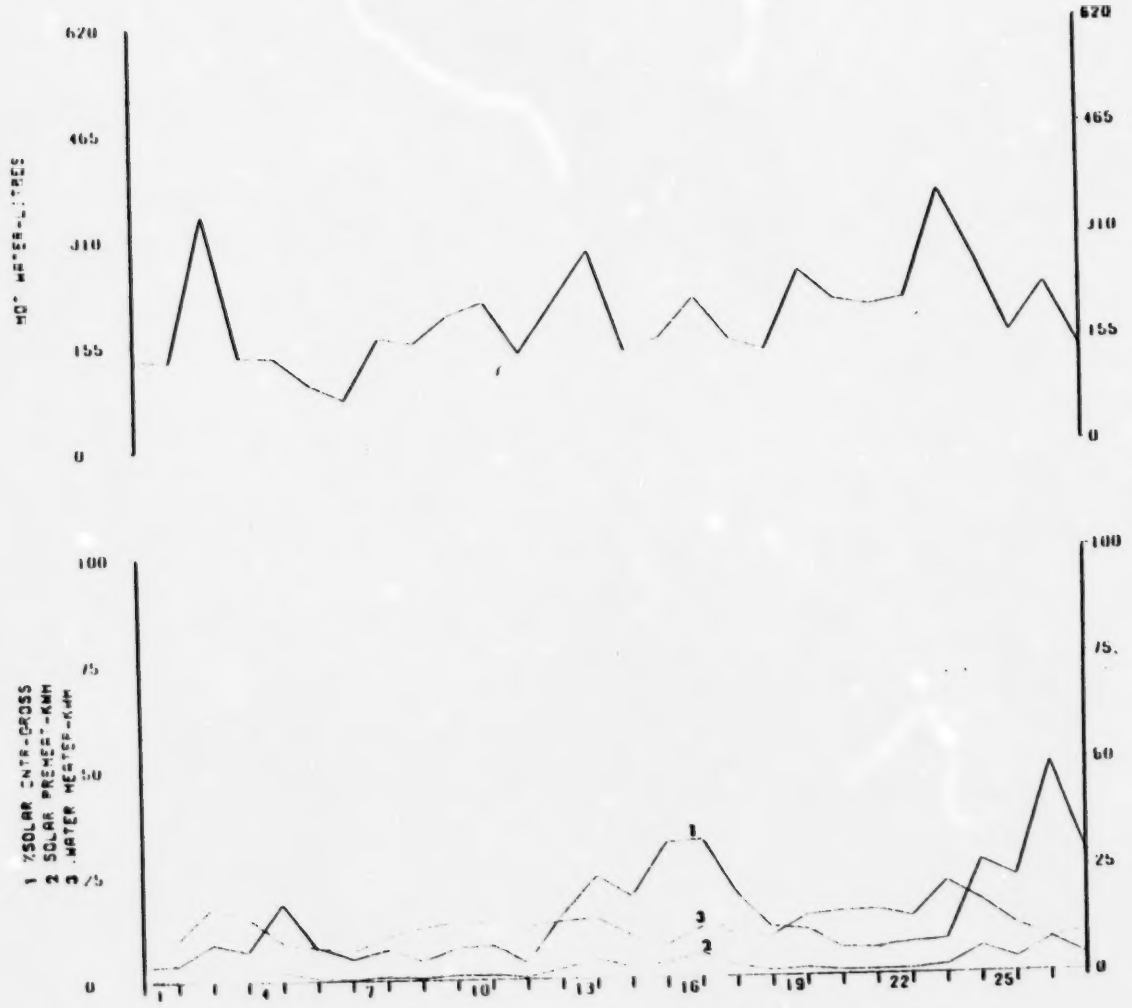
DAILY DATA - FEB., 1981

SYSTEM 1



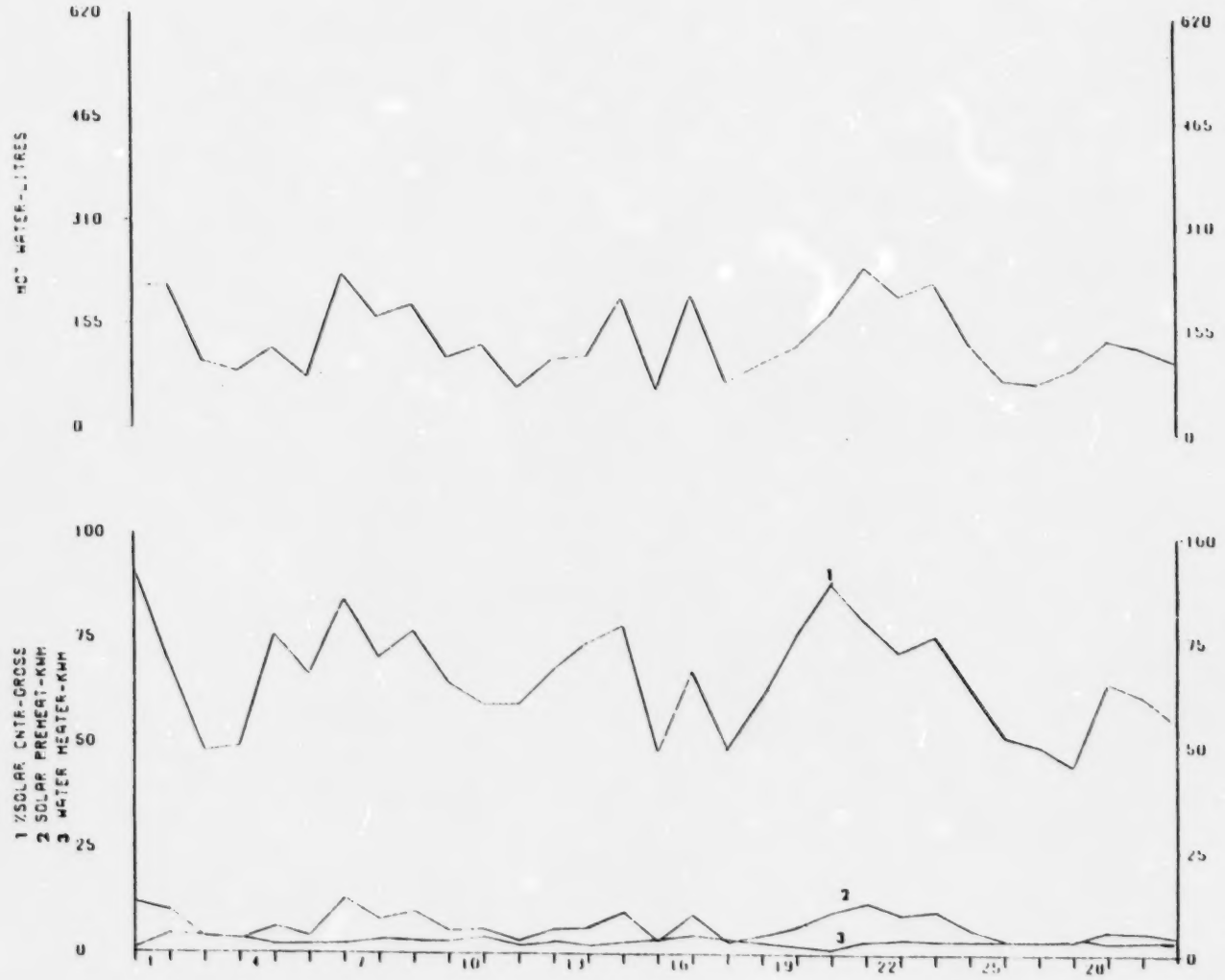
DAILY DATA - JULY, 1981

SYSTEM 1



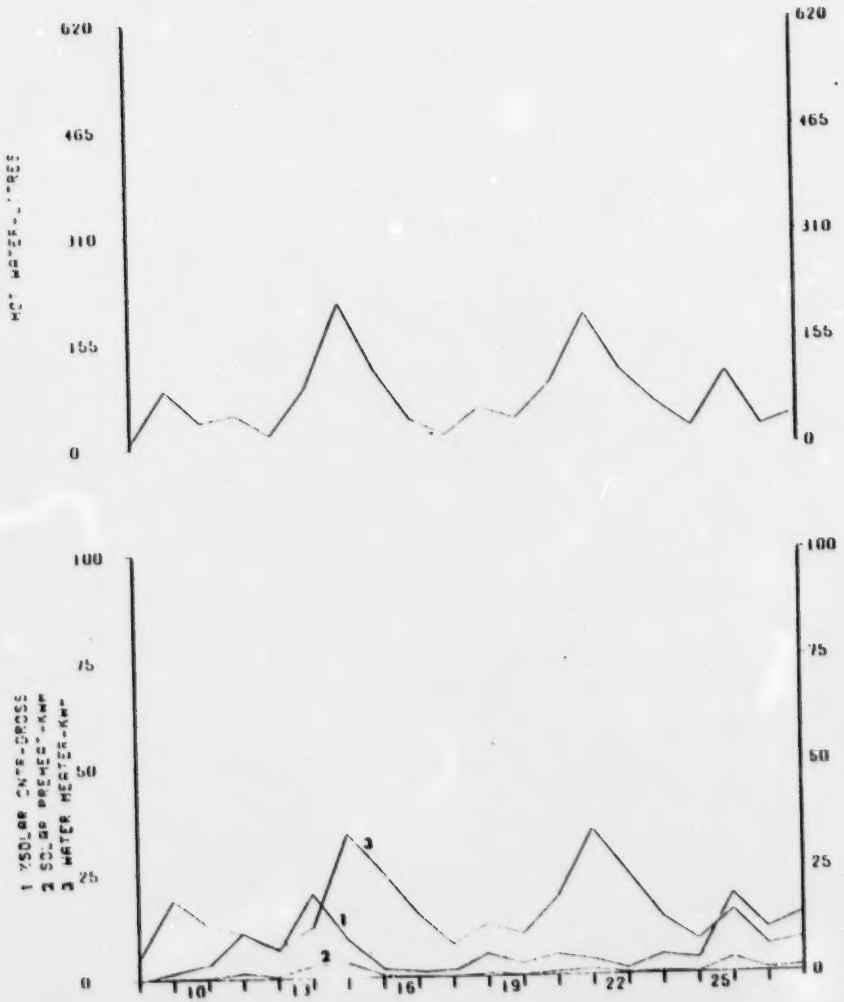
DAILY DATA - FEB.. 1982

SYSTEM 1



DAILY DATA - JULY, 1982

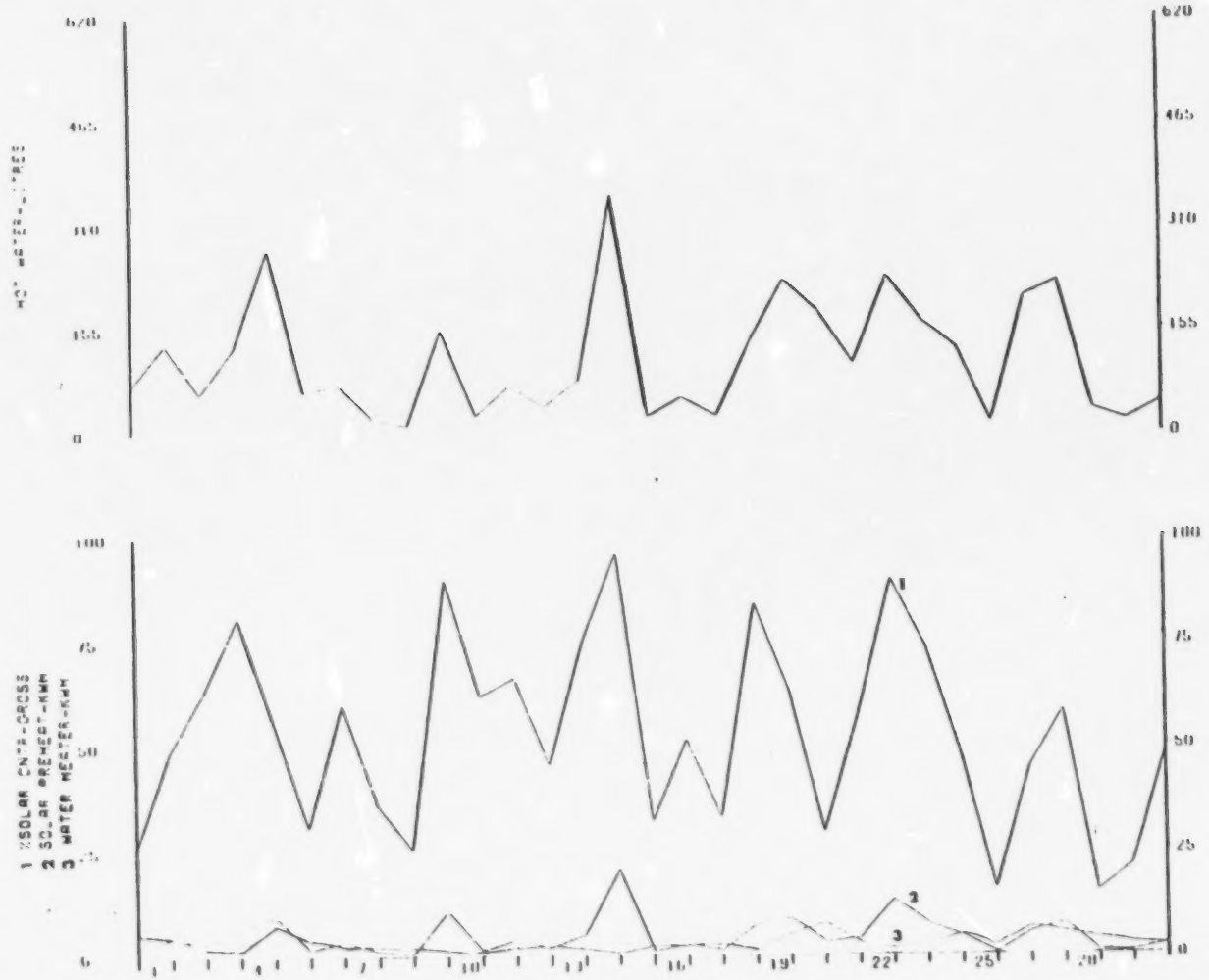
SYSTEM 1



DAILY DATA - FEB. 1981

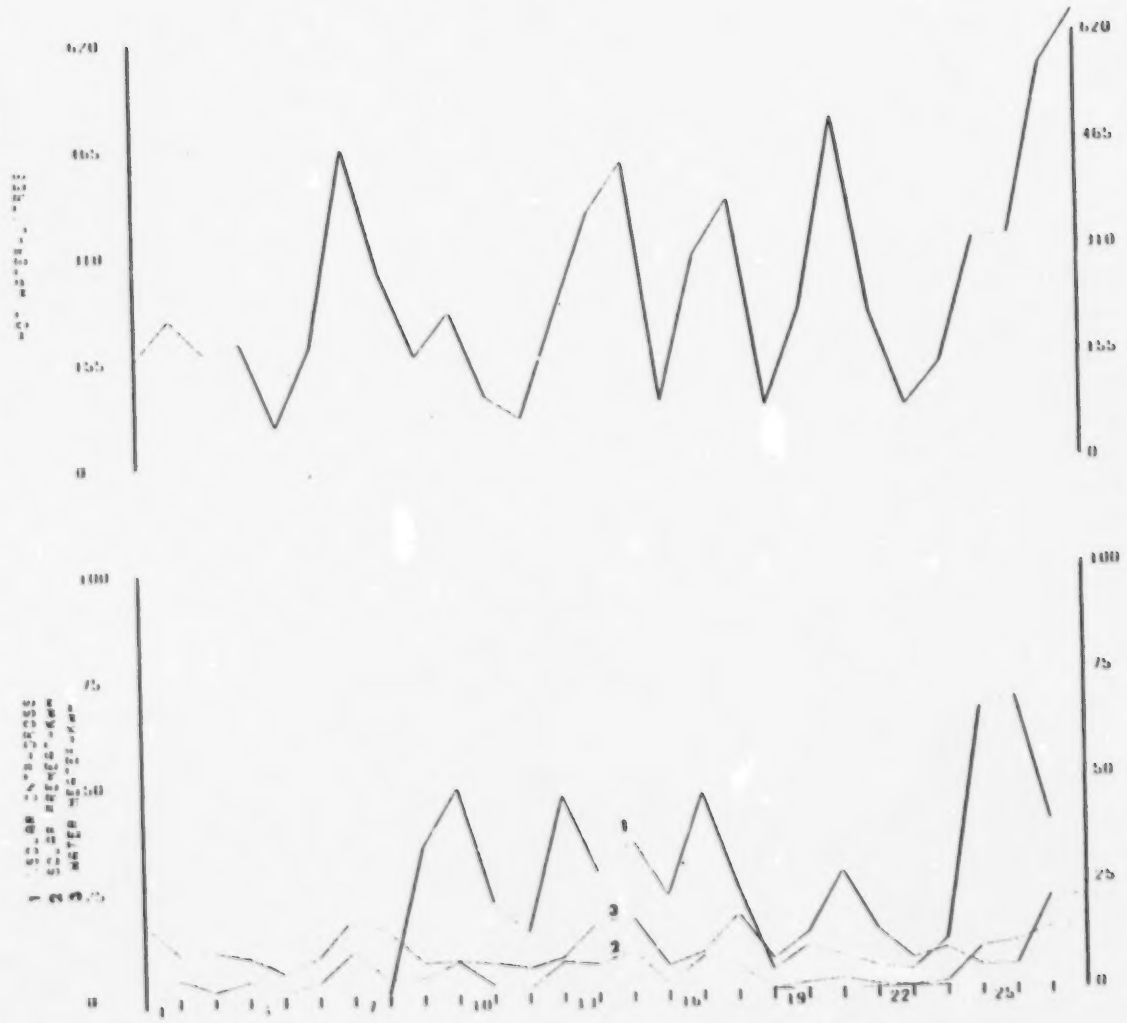
SYSTEM 2

Note: Monitoring Equipment not Operational February 1-8



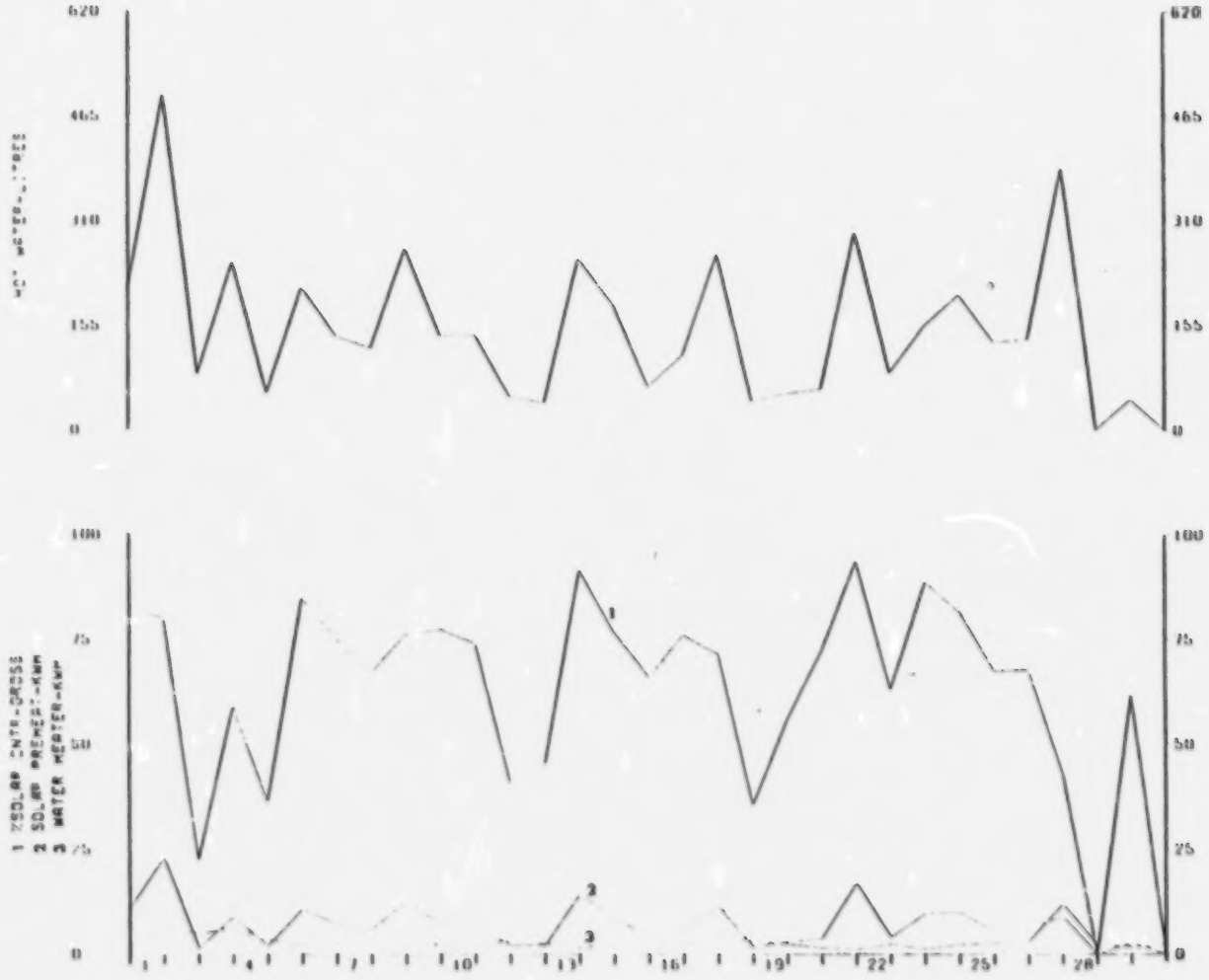
DAILY DATA - JULY 1981

SYSTEM 2



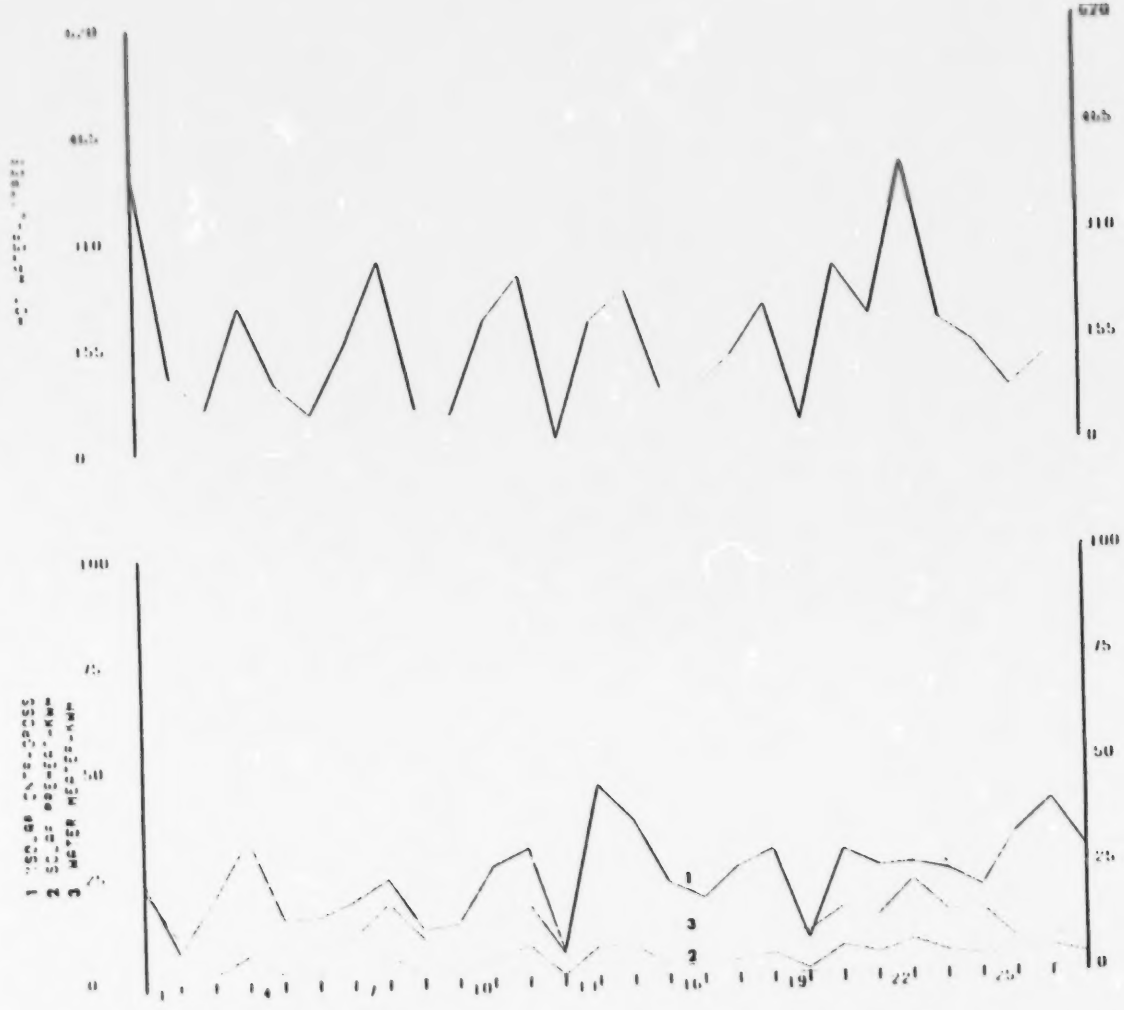
DAILY DATA - FEB. 1982

SYSTEM 2



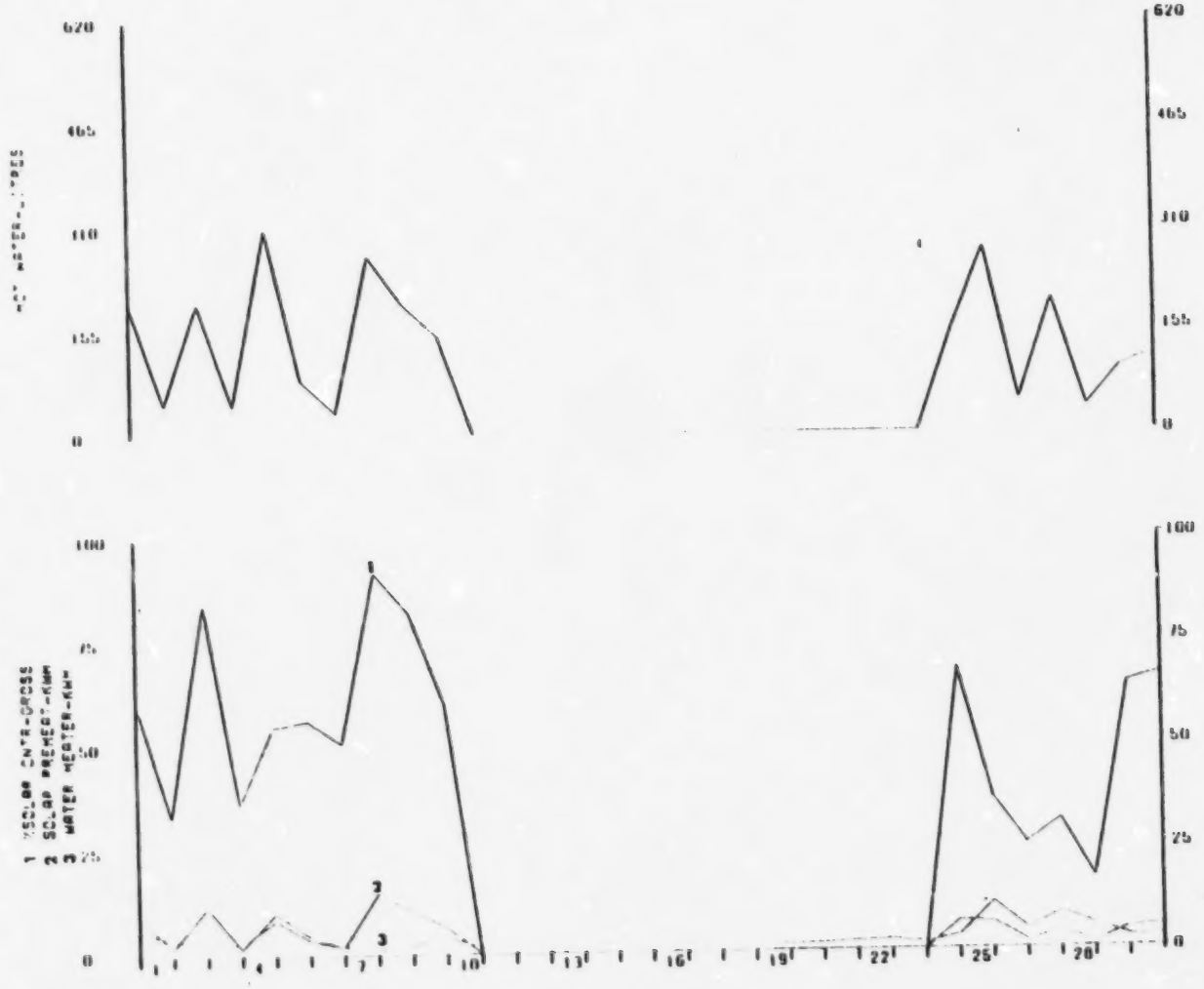
DAILY DATA - JULY 1982

SYSTEM 2



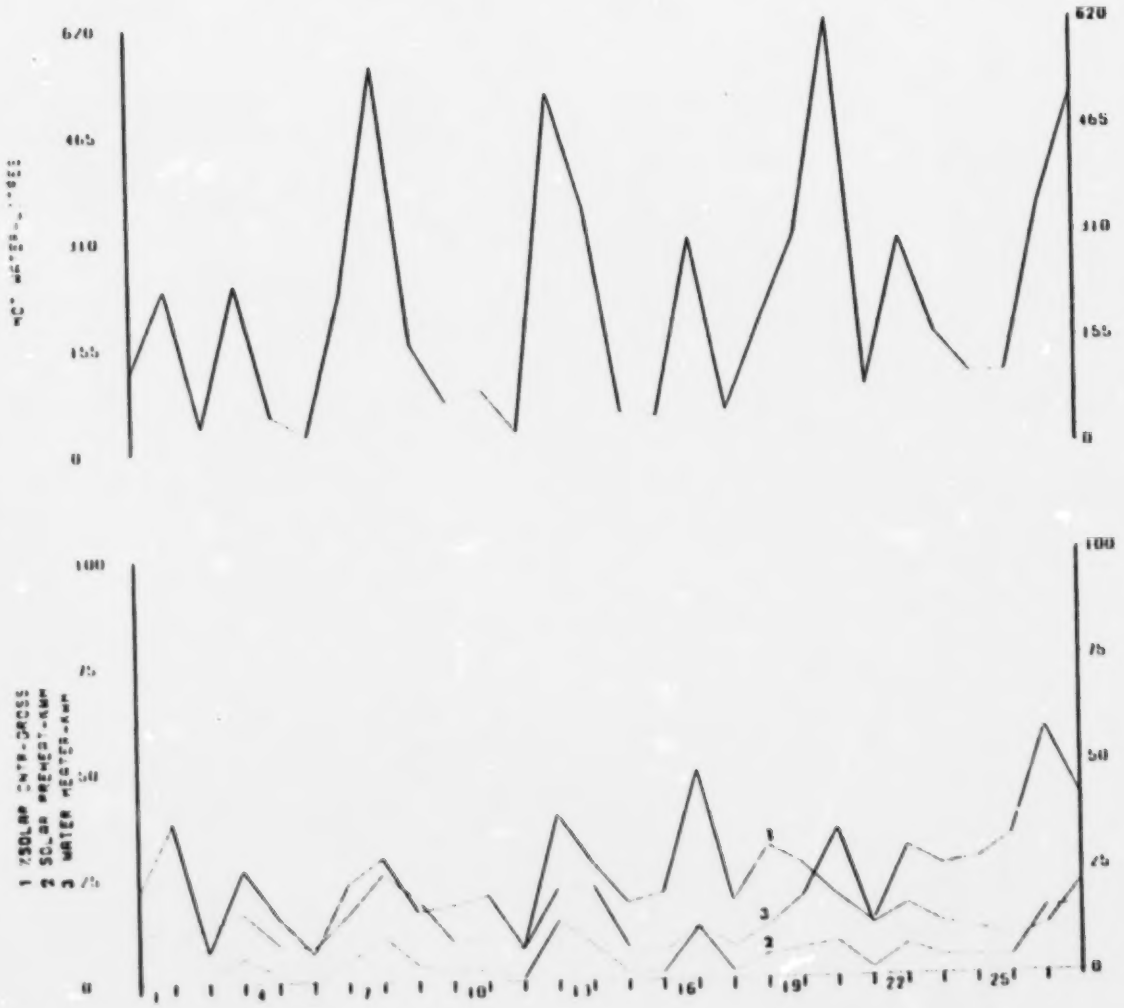
DAILY DATA - FEB. 1981

SYSTEM 3



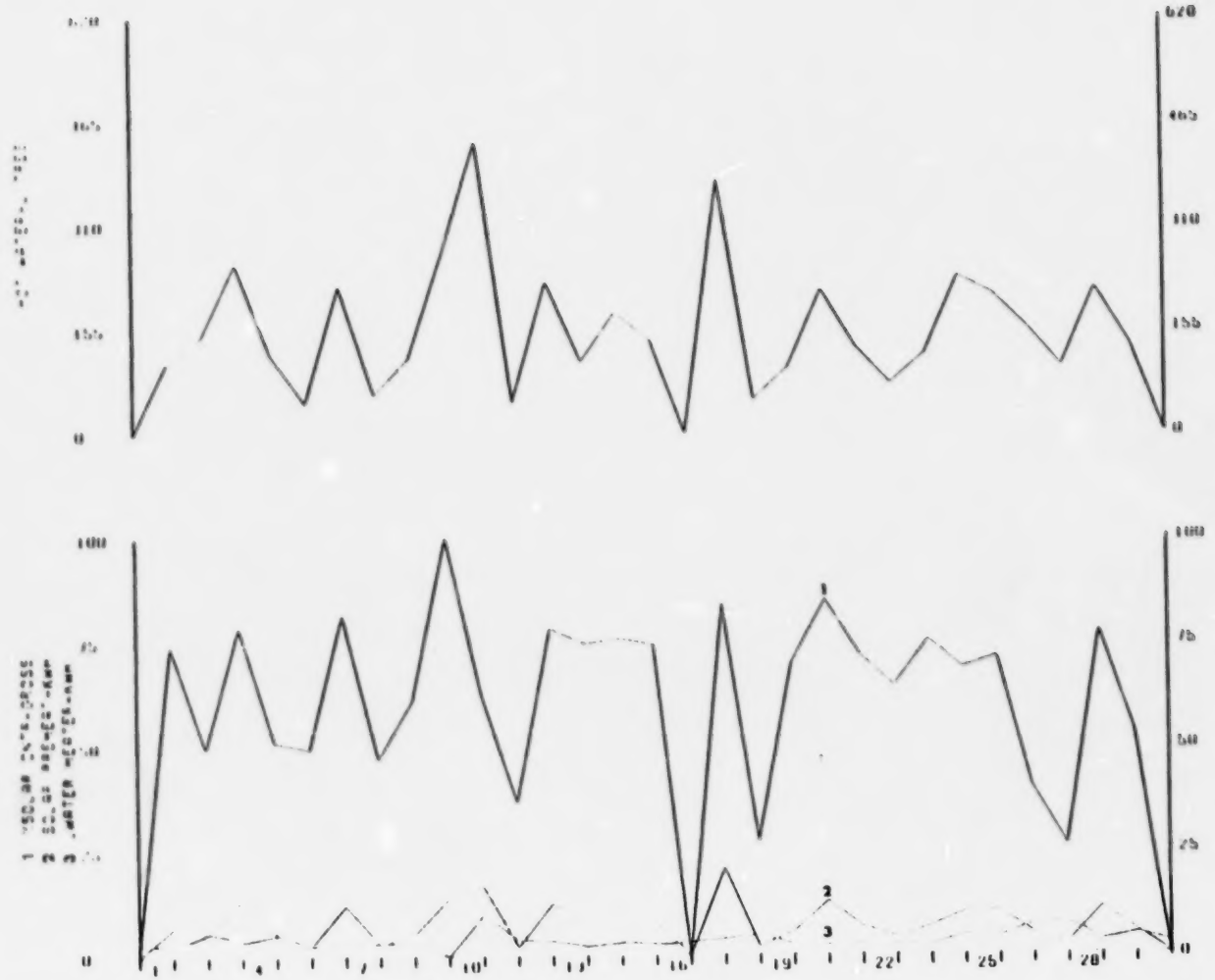
DAILY DATA - JULY 1981

SYSTEM 1



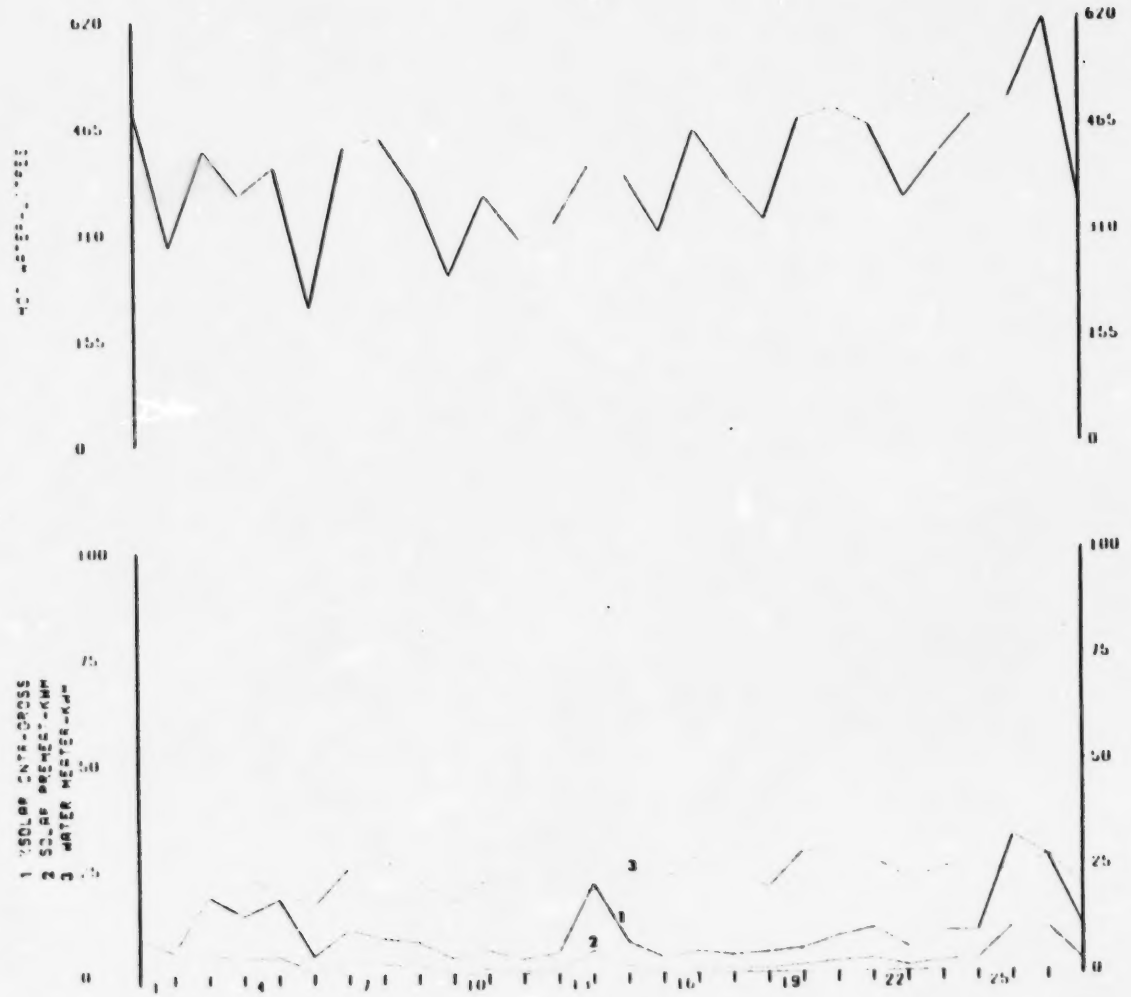
DAILY DATA - FEB. 1982

SYSTEM 1



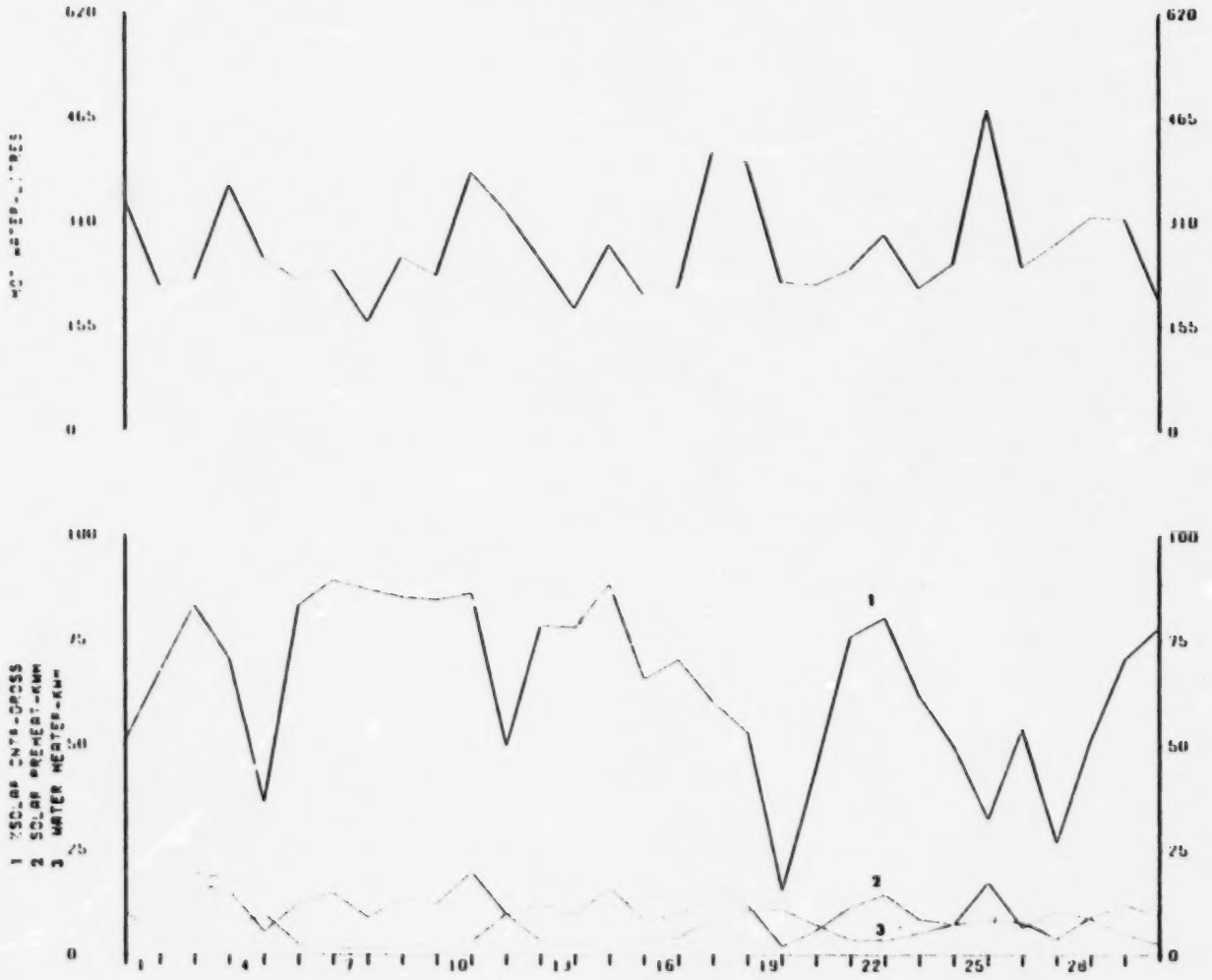
DAILY DATA - JULY 1982

SYSTEM 3



DAILY DATA - FEB. 1981

SYSTEM 4

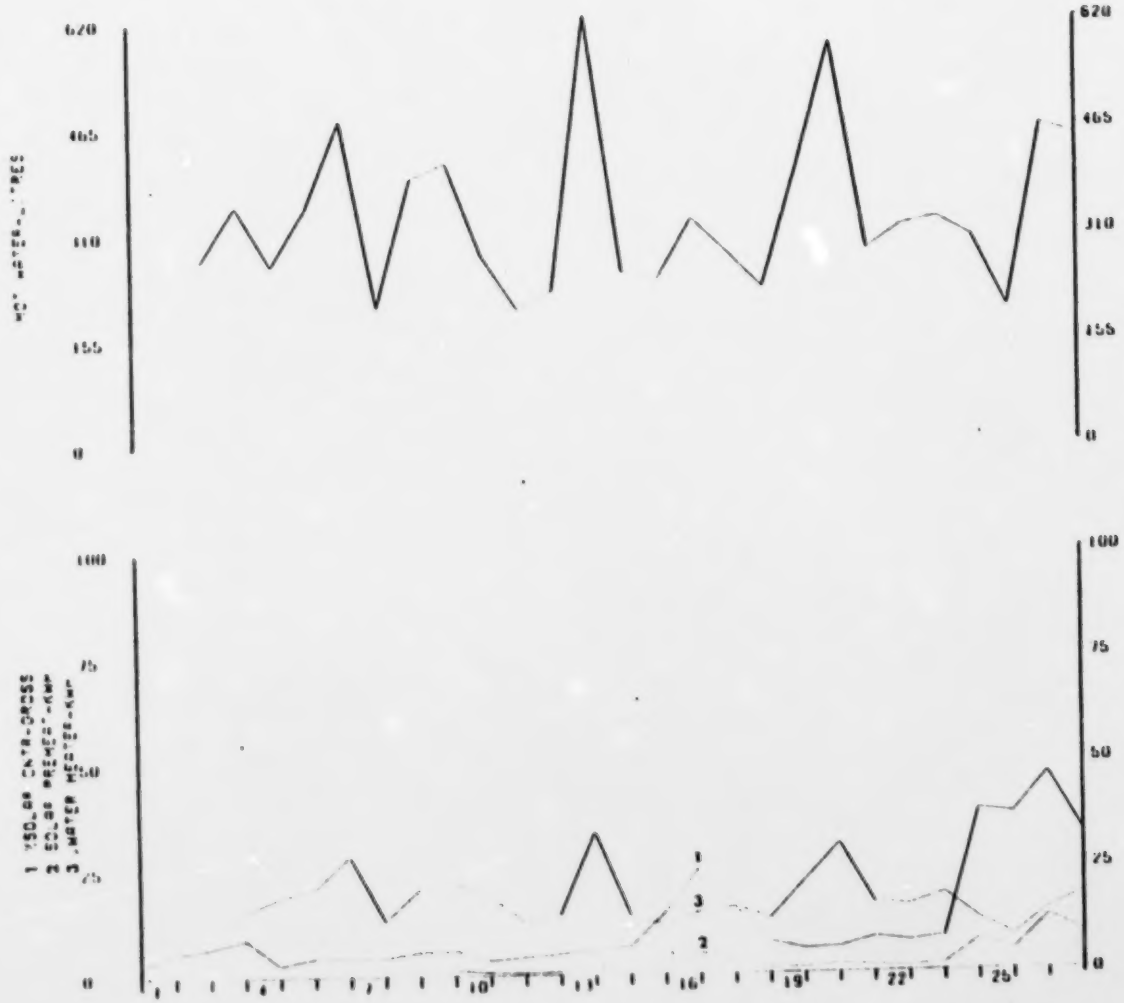


DAILY DATA - JULY, 1981

SYSTEM 4

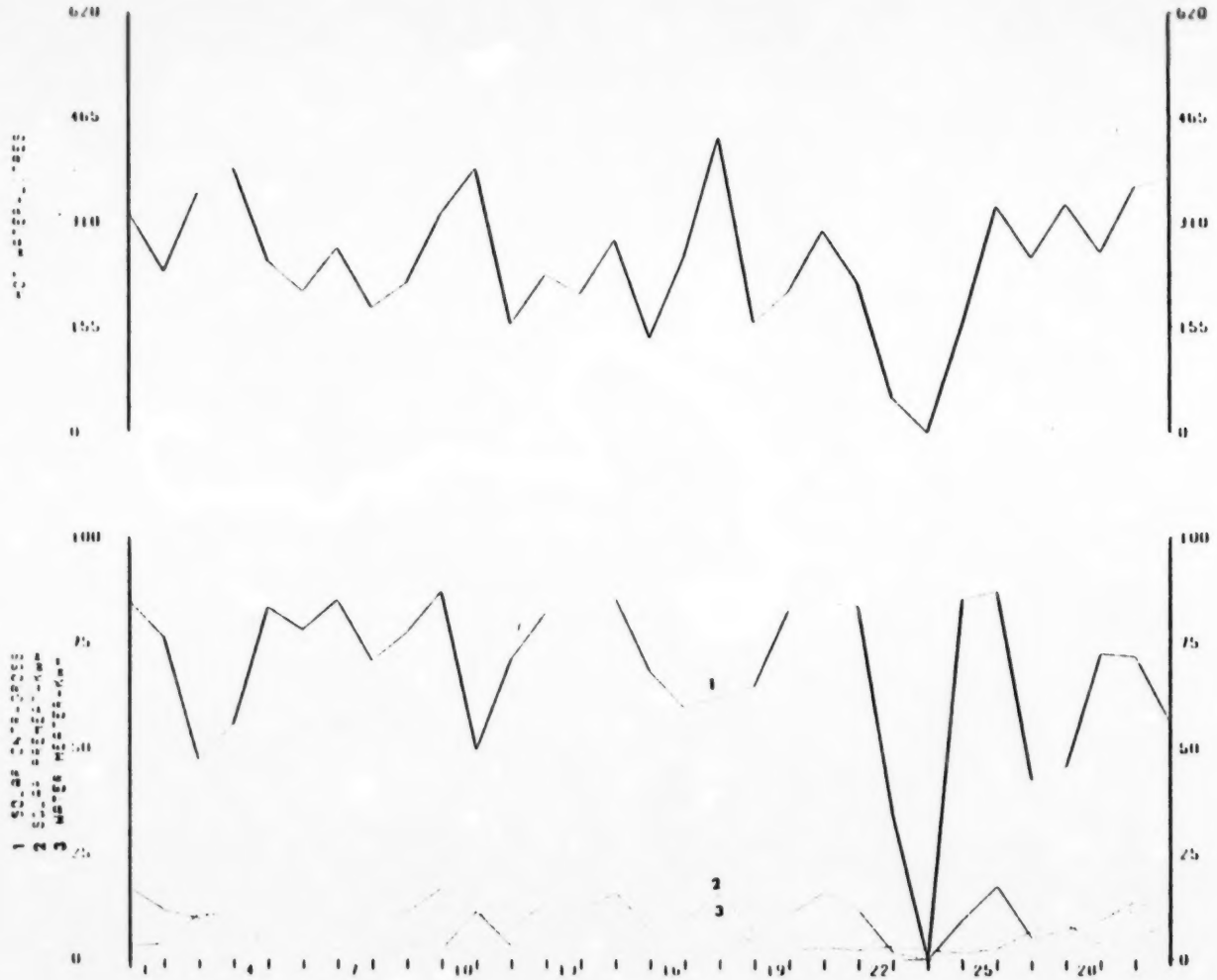
- 38 -

83-352



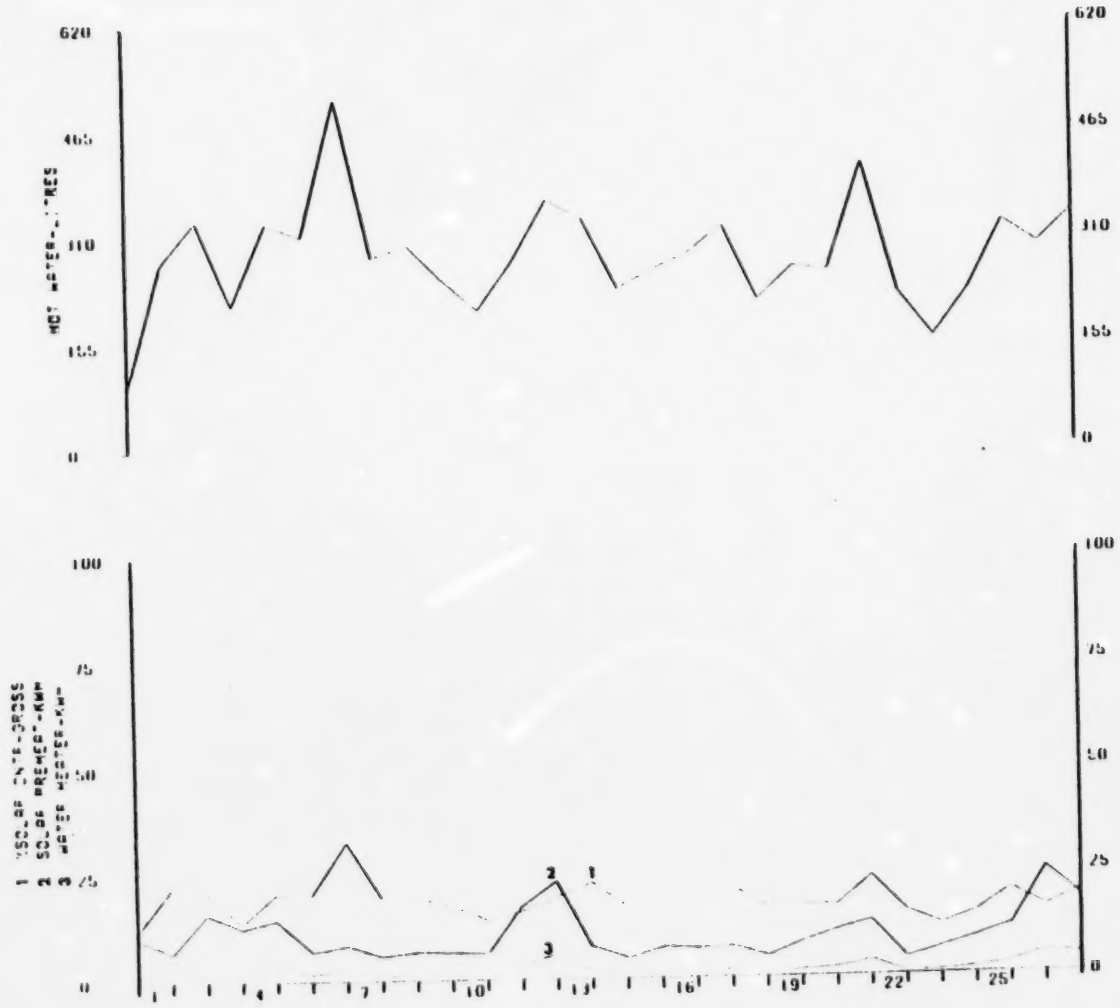
DAILY DATA - FEB. 1982

SYSTEM 4



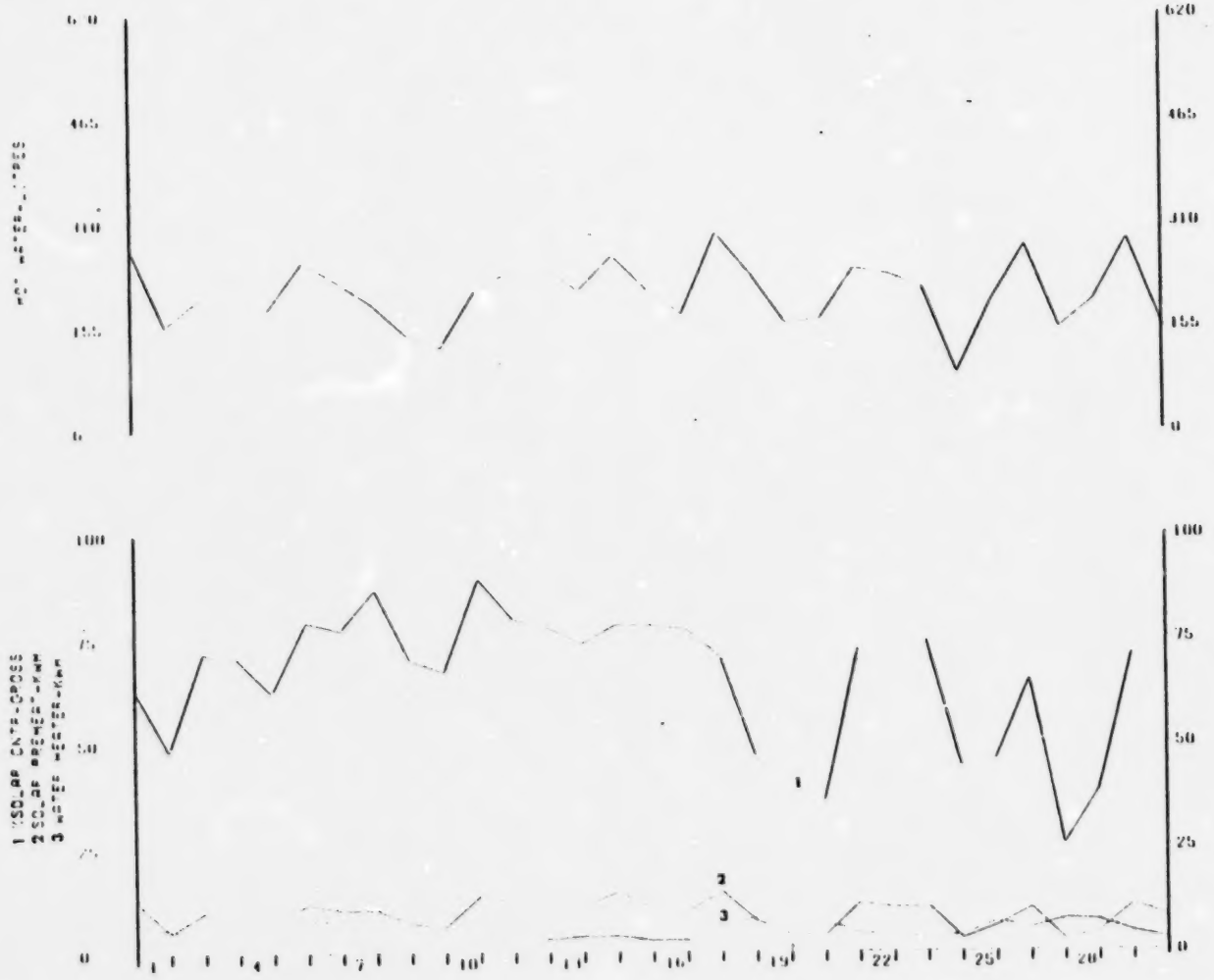
DAILY DATA - JULY, 1982

SYSTEM 4



DAILY DATA - FEB. 1981

SYSTEM 5



DAILY DATA - JULY 1981

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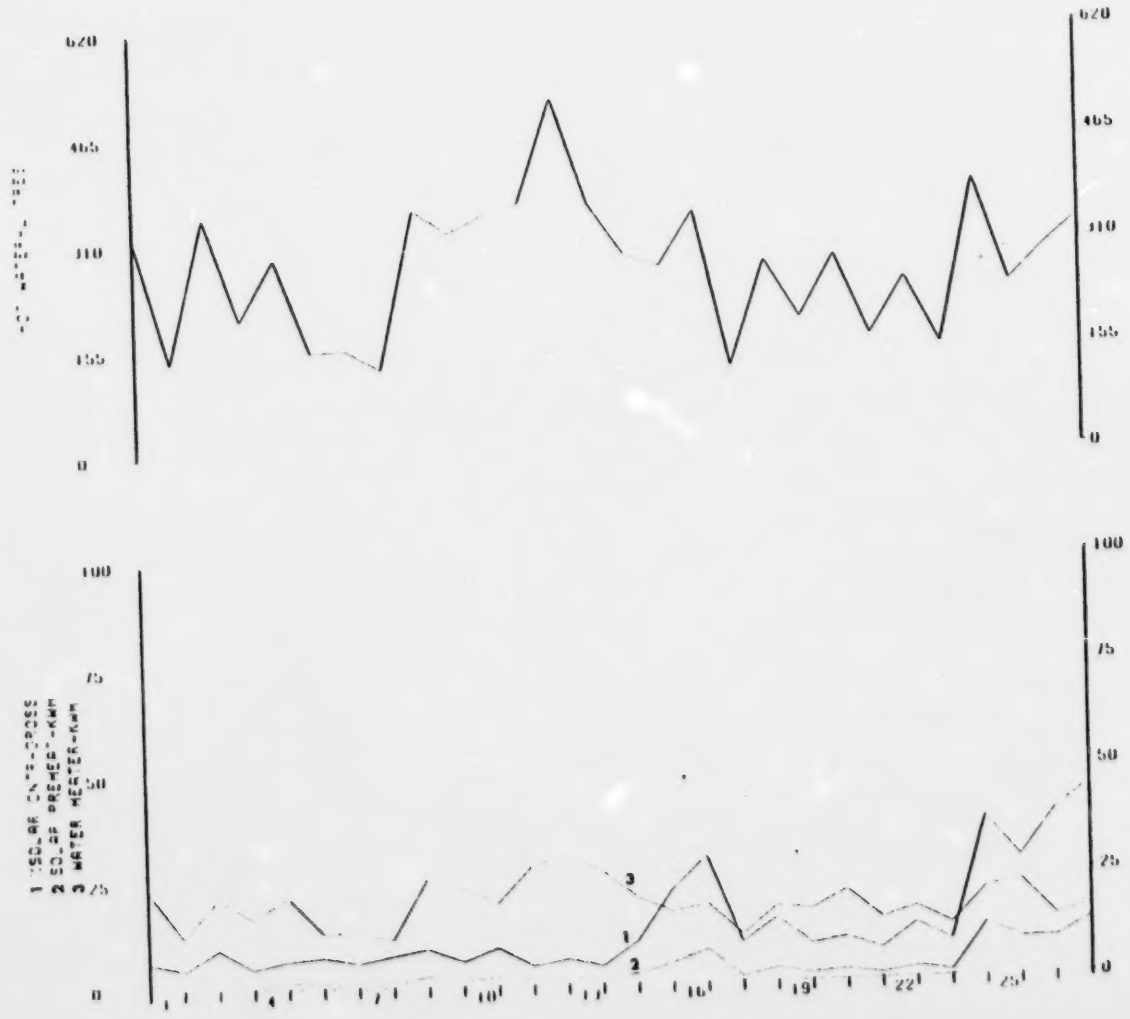
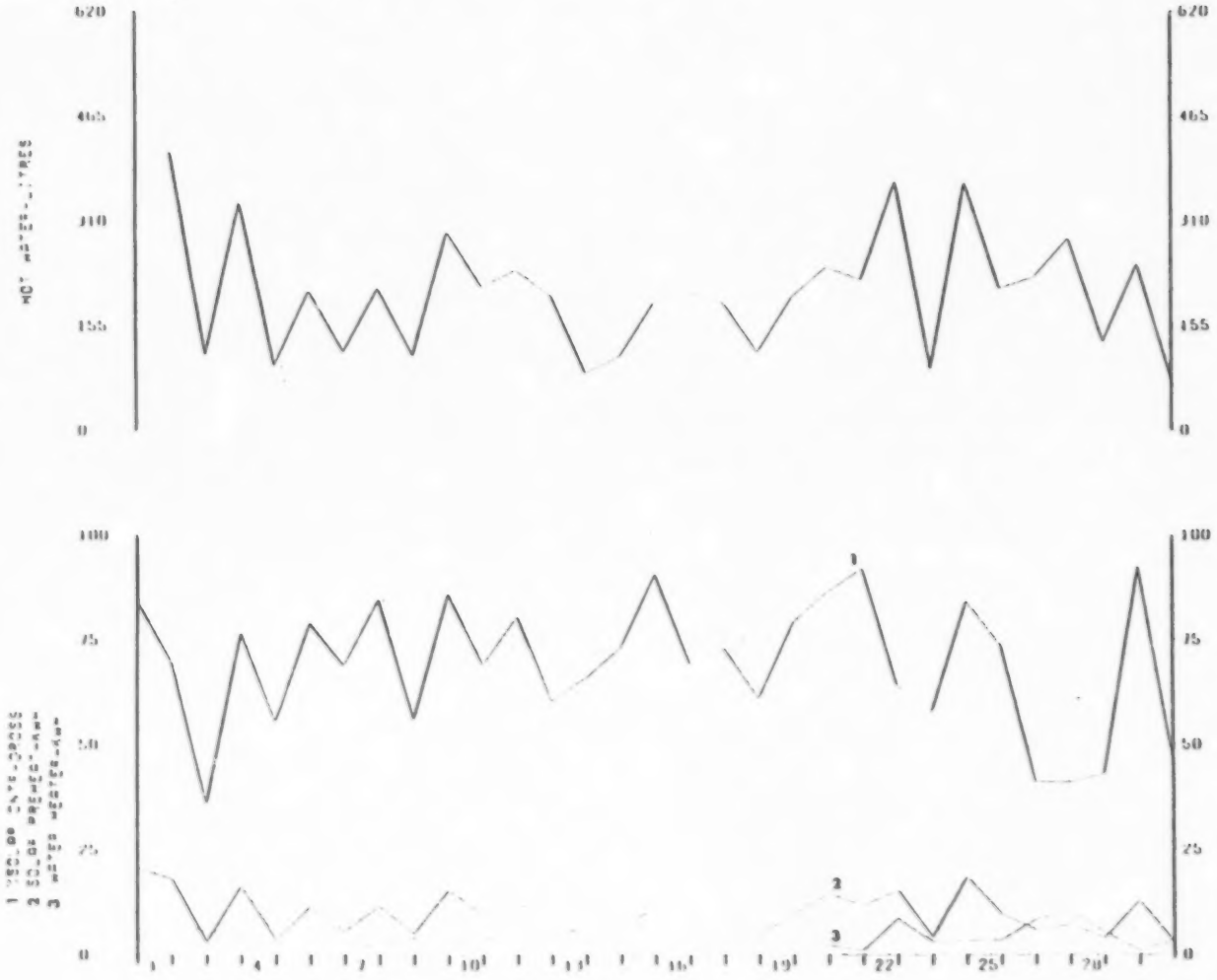


DAILY DATA - FEB. 1982

SYSTEM 5



DAILY DATA - JULY 1982

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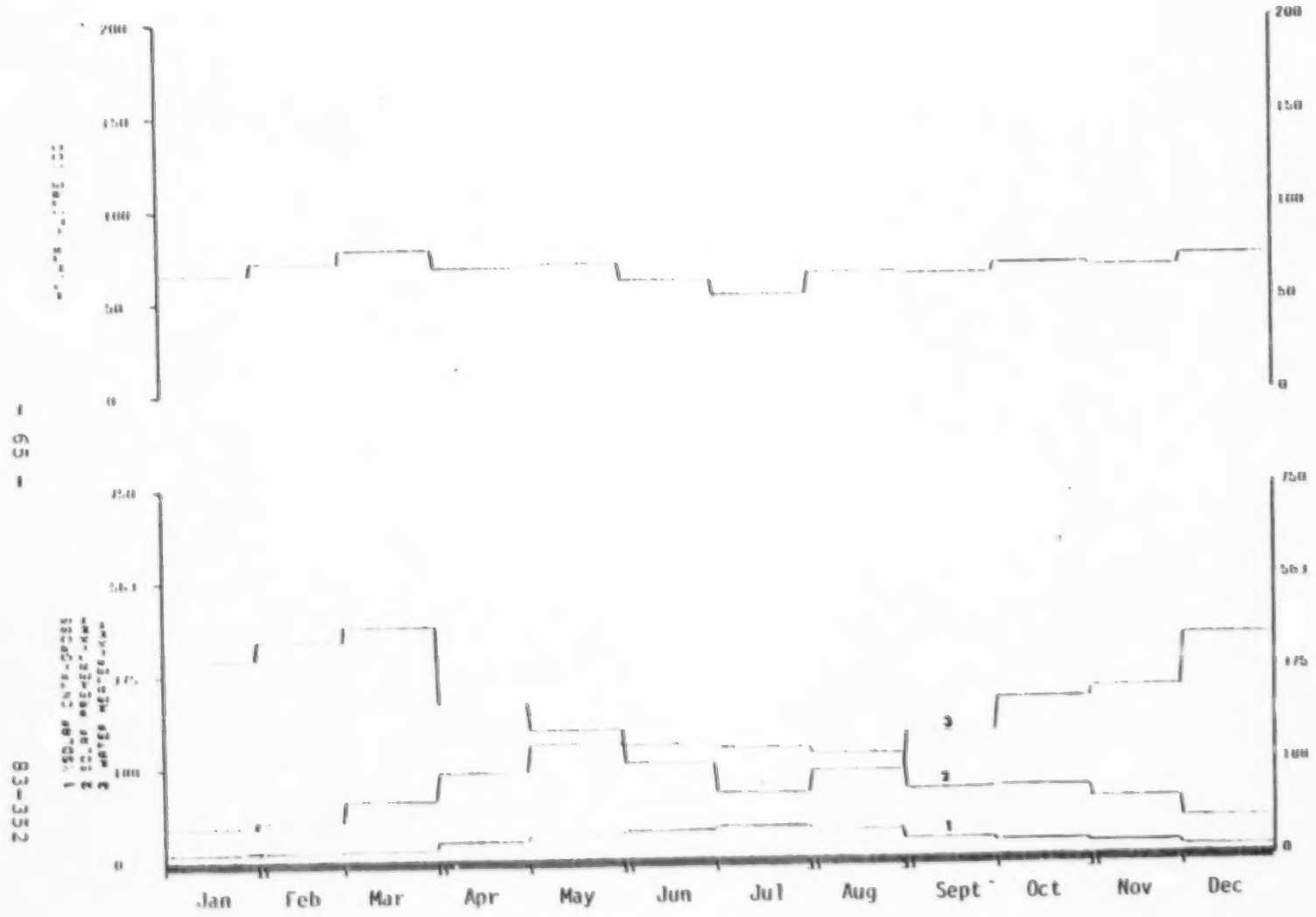
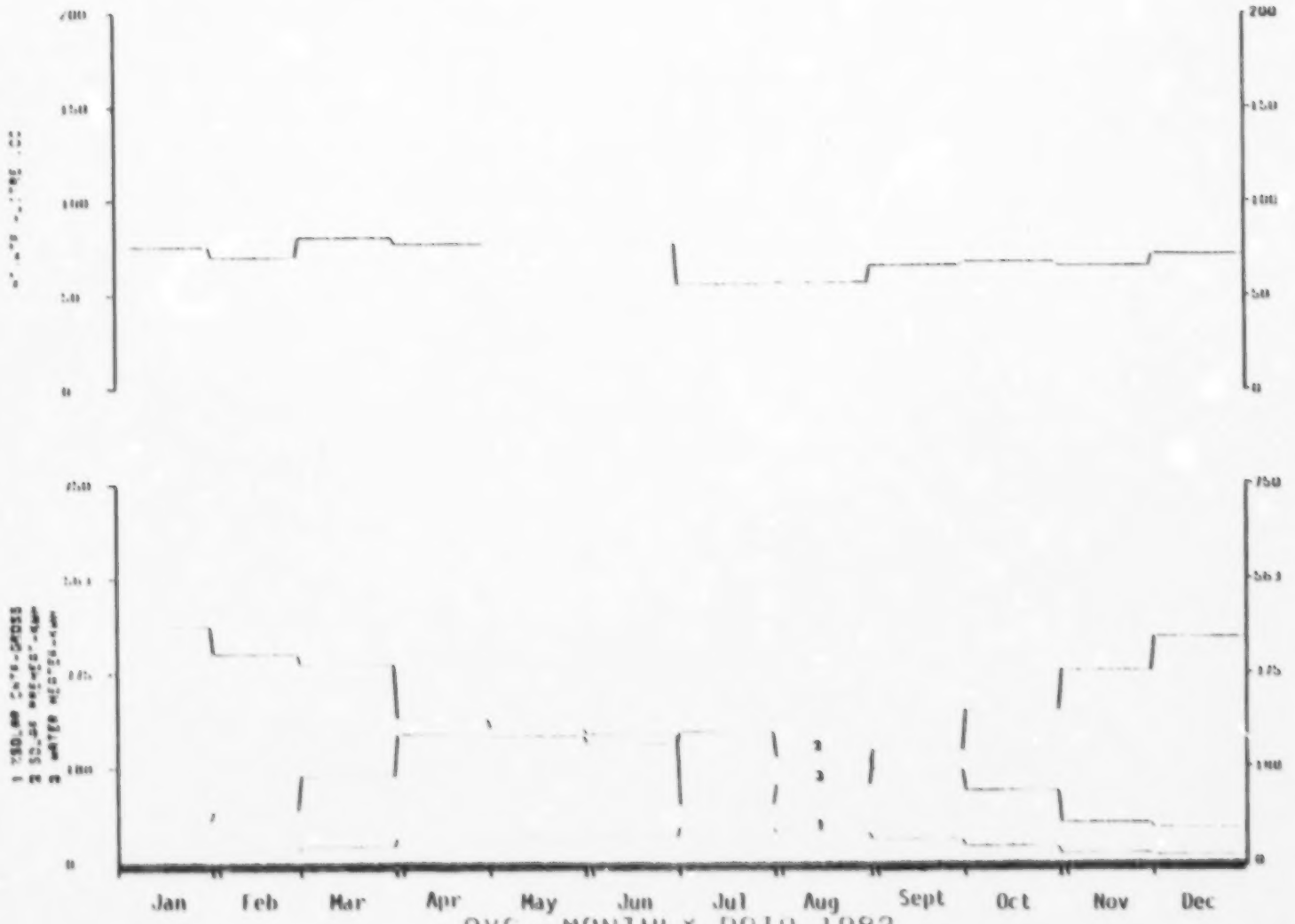


AVG. MONTHLY DATA 1981

83-352



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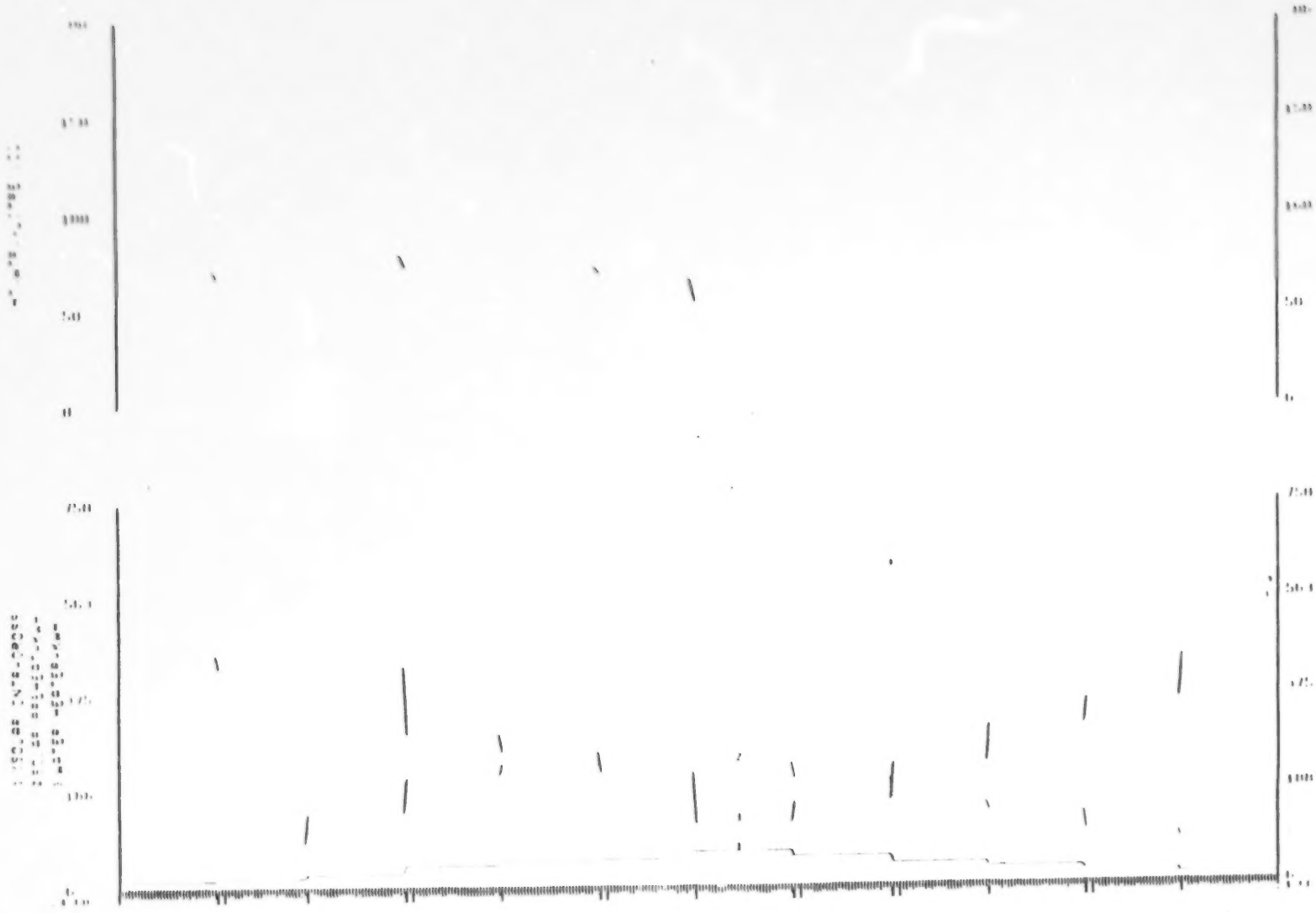

FOR TWO YEARS 1981/1982